

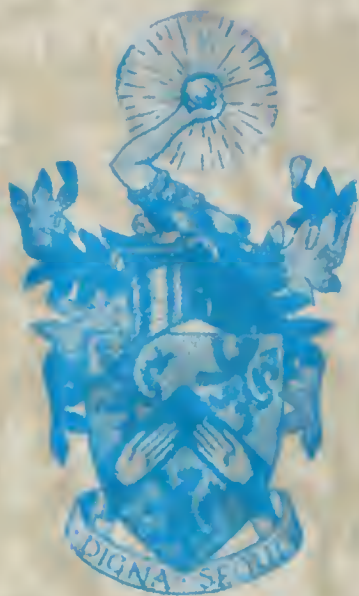
ELECTRICITY

FOR

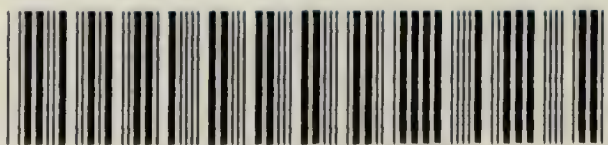
GENERAL PRACTICE,

BY

F. Stewart Povah and F. Davidson.



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ELECTRICAL TREATMENT FOR
GENERAL PRACTICE.



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SECOND EDITION.

Electrical Treatment

FOR

General Practice,

BY

F. STEWART POVAH & F. DAVIDSON.

Price 3/= Nett.

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INTRODUCTION.

IN bringing this manual before the medical practitioner, we do so in response to repeated requests for a simple work which will enable him to easily acquire a certain amount of necessary electrical knowledge. It will be readily admitted that the practice and experience of recent years have conclusively shown the value, from a professional point of view, of electrical treatment and we would add, that from a pecuniary point also, medical men would be well advised to give the subject increased attention.

The always increasing competition, which makes general practice of the orthodox type so frequently unprofitable, should set one thinking if it is not worth while to launch out in a field of work which promises to give much better results in return for one's labour.

We would like it to be distinctly understood that this little work is written especially for the practitioner who has hitherto paid little or no attention to a subject which is daily becoming of increased importance. It is not intended that this manual shall get into the hands of any except medical men, as we have no desire to popularise the work amongst laymen. It is in order to be able to control its sale that we publish it ourselves.

Those desirous of further study cannot do better than read—

“ELECTRICAL TREATMENT,” by W. Harris M.D.

“MEDICAL ELECTRICITY,” by Lewis Jones, M.D.

“ESSENTIALS OF MEDICAL ELECTRICITY,”

by Reginald Morton, M.D.

“ELECTRIC IONS,” by Professor Stephane Leduc.

The cost of embarking upon this work *need not be excessive*. We mention this, as we know of many who have been frightened by the estimates of cost submitted.

Tuition is given privately and free of cost at 29, GT. PORTLAND STREET to those medical men desirous of taking up the subject.

As business people we commend it.

F. DAVIDSON & CO.

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The Value and General Therapeutic Consideration of Electrical Treatment.

CHAPTER I.

Electrical treatment has up till quite recently been looked upon as a somewhat doubtful method of treatment. Now, however, thanks to the valuable work of Dr. Lewis Jones and others in this country, there is little, if any, doubt as to its utility and many great advantages.

The electrolytic transport of ions and its employment for medical purposes in the administration of drugs, is of very great importance; the therapeutic effect of the X rays and of radium, high frequency currents and also of electric light, all agents of proved value. With these facts in view, surely it is to the advantage of the general practitioner to give the subject his most serious attention. The public expect to get the advantages of recent research and do not like it when told in every case that it will be necessary for them to go to a specialist. In general practice there are numberless cases in which a course of electrical treatment would be most advisable; but the patient cannot really afford a specialist's fee. It is for the needs of these that the general practitioner can cater. There is so much sound practical treatment that can be given with the aid that this manual will afford (and at a comparatively small cost for the necessary appliances) that "MEDICAL ELECTRICITY IN GENERAL PRACTICE"

is both easy to acquire and administer. There are certain governing principles to be understood which it is the object of these pages to teach. With a proper knowledge of these, there is a great deal of valuable work within the reach of the general practitioner, who may thus increase both his reputation and his practice.

The apparatus described and illustrated are only those which have been selected as being most suitable for the general practitioner. Elaborate and showy appliances have been excluded.

A series of QUESTIONS AND ANSWERS will be found on pages 78 to 87, which will recommend themselves to those who are not too familiar with electrical matters.

ELECTRICITY.

Those wishing to have a correct idea of this science should read Sir Oliver J. Lodge's book "Modern Views of Electricity." The author divides his subject into four parts:—

- (a) **STATIC ELECTRICITY.**—This branch deals with the properties of electrically charged bodies and their charge and discharge.
- (b) **CURRENT ELECTRICITY,** which deals with the flow of electricity along conductors.
- (c) **MAGNETISM,** or electricity in rotation.
- (d) **RADIATION,** or electricity in vibration.

CHAPTER II.

Storage Batteries.

A brief description of Primary and Secondary Batteries often used for portable medical batteries may be of interest. Primary dry cells are made of a zinc plate in the form of a tank, lined with a paste of exciting material, and inside this is the carbon and manganese dioxide. The capacity is limited by the original charge of chemicals and cannot be restored when run down. They are exceedingly useful and weigh from 8 ozs. With care they will last a year of daily use.

They are generally of from 1 to $1\frac{1}{2}$ volts and are used in the various forms of constant current apparatus.

The Three Cell Dry Battery.

There is however another form of dry battery in use for medical purposes, principally illumination, namely one containing three cells each of $1\frac{1}{2}$ volts connected in series = $4\frac{1}{2}$ volts. This battery is usually of small pocket size. Frequent complaint is caused however by the fact that it exhausts itself if not used for some time. This propensity obviously causes a medical man much inconvenience at times. This particular type of dry battery is not intended for a long *continuous* use or it will speedily become exhausted. With intermittent use it lasts a reasonable time.

A NEW TYPE OF DRY BATTERY has been recently introduced called the "DAVON" (Reg.) which practically does away with the cause of complaint referred to. It may be kept

unused for several months and the deterioration is somewhere between 5 and 6 % of its efficiency. It has twice the capacity of the ordinary type and possesses the unique property of being efficient for light cautery work. It is made in London and is the best thing of its kind.

THE "DAVON" (REG.) DRY BATTERY.

No. 500.

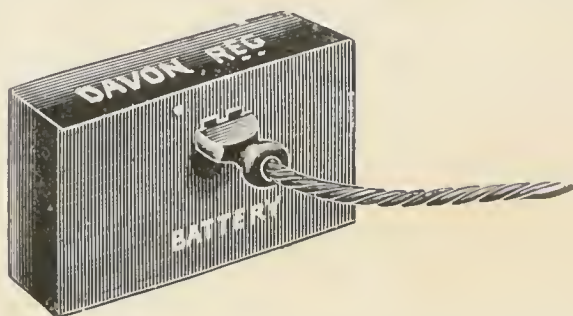


Fig. 1 A.

After a great deal of experiment we are able to offer the medical profession a dry battery which will not deteriorate more than 5 % *if not used for a year*. We are aware from past experience that a great deal of trouble has been caused by the fact that the dry batteries hitherto in use suffered materially if not used, and it has been our aim for some time past to overcome the difficulty, and we are happy to say that we have succeeded. It is within our knowledge that many medical men have fought shy of using portable electric appliances because the batteries were not always to be depended upon.

Secondary Batteries or Accumulators.

The secondary battery has the advantage over the dry cell, as it may be re-charged when run down by forcing into it an electric current, thus setting up the action which brings back the former state of the plates and electrolyte.

An accumulator is a vessel containing two or more sets of lead plates, called the positive "+" and the negative "—" plates, and

a solution of sulphuric acid, 1 part of acid to 5 of distilled water.

An accumulator is charged by passing a current into it in the direction from positive to negative through the acid, and when charged it is able to give out a current in the opposite direction until the energy stored in it by the charge is exhausted

It should not be discharged at an excessive rate; but when at the proper rate as marked on most accumulators, and charged in a proper manner, will last a very long time. Directions for charging are often given with each type of accumulator and should be strictly adhered to, and are explained on pages 75, 76, and 85.

A useful type is here illustrated.

THE "DAVON" ACCUMULATOR.

No. 26.

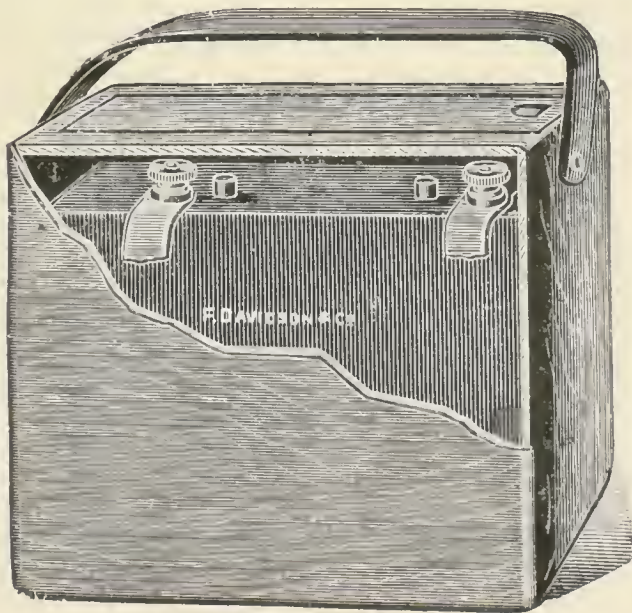


Fig. 2 A.

4 volts. 5 plates per cell.

Capacity :—34 Ampère hours.

Charging rate :— $1\frac{3}{4}$ Ampères for 12 hours.

Dimensions :— $7\frac{1}{2}$ in. \times 6 in. \times $1\frac{3}{4}$ in. *Weight* :— $7\frac{1}{2}$ lbs.

Leclanché Cells.

These cells are often used in medical work chiefly on account of their simplicity. They do not require a great deal of attention. The great drawback, however, is that they are not really portable and so cannot be used in batteries made for the application of the Constant Current. They will do good work when kept stationary.

The most general type consists of a square shaped glass jar into which is placed what is called a Porous Pot containing the carbon electrode surrounded by Manganese Dioxide. The top of this pot is sealed up, leaving only the carbon terminal exposed. The second pole is made of a zinc rod. *Both* the porous pot and the zinc rod are placed in the jar which contains a solution of say six ounces of Salamoniac to one pint of water. The glass jar should be about three parts full. No action takes place unless the circuit is closed, and consequently these cells last a very considerable time.

When the circuit is closed, action takes place between the Manganese Dioxide, aided by the solution, which penetrates the Porous Pot and acts on the Carbon. On the Zinc, however, the greatest change appears, for the solution gradually dissolves this electrode. The current obtained from each of these cells is about 1.5 volts, and when they are connected up in series a large voltage may be obtained.

They are mainly used for telephones and electric bells; but may be used, as before mentioned, for medical work. They may also be used for the illumination of small surgical lamps requiring only a small ampèrage; but they are *not suitable* for such work as Caутery, the reason being, that this work requires too great an ampèrage. To try this on these cells only produces rupture, or in other words polarisation.

Bichromate Batteries.

This type is seldom used now except where there is no electric supply and a large output of current is required.

They differ from the Leclanché Cell not only in their construction, but in the solution used. They have many drawbacks, such as smell and the need of constant attention and care in handling on account of the acid used.

The most general type consists of a glass jar fitted with an adjustable top holding the electrodes and arranged so that the latter may be withdrawn from the solution immediately after use. This is absolutely necessary, for if not carried out, the action goes on all the time whether the circuit is open or closed.

The electrodes are Carbon and Zinc and the solution is made up of about six or seven ounces of Potassium Bichromate with six and a half ounces of Sulphuric Acid in about two pints of water.

These batteries may be used for most purposes; but they cannot be recommended. It is far better to use Accumulators, which only need reasonable care and seldom require re-charging more than every two or three weeks.

These are fully described on pages 14 and 15, as are also Dry Batteries on pages 13 and 14.

CHAPTER III.

House Current.

The house supply may be utilized for all kinds of electrical treatment and either the direct or alternating current may be used, *providing it is taken through suitable resistance* in order that the voltage may be reduced to the amount required.

When the alternating current is laid on to the house, a specially wound transformer is necessary to alter it into a direct current.

When the necessary appliance is in position and duly connected up to the supply THE FIRST CARE must be to be certain that the flow of current is entering the instrument in a proper manner, so that the positive terminal really gives a positive current and the negative terminal a negative current.

Testing the Flow of Current.

This may be easily done by testing the wires entering the appliance by pole-testing paper, in the following manner:— Saturate the testing paper and place on a table, then take the two wires of supply, one in each hand, place them near to one another on the paper and gradually draw away from each other. The negative pole will mark the paper with a purple stain. Thus we can judge which wire carries the positive and which carries the negative pole of the current.

Many men have Litmus paper always in their possession. This serves equally well as a pole-tester, the only difference between this and ordinary pole-testing paper is that the *positive* wire makes a *red* stain instead of the *negative* making a *purple*.

General Electrical Treatment.

It is of the utmost importance that even the simple forms of electrical treatment should be carried out by the doctor himself when possible.

It often happens that the medical man has little time to spare; but if good results are to be obtained, the utmost care must be exercised in the first applications and if he has a good nurse at hand, he will be able to hand the patient over to her after the second or third application, having fully explained the method and manner of application to her. He will then only have to keep an eye on her and in some cases take measurements and tests from time to time.

Electrical Treatment in many cases takes a long time and often patients fret and give it up before they should. Many doubtless do so on account of the cost. It is this point that the doctor should take into consideration and endeavour to secure a reliable nurse and thus save himself a number of calls. Another point that must be remembered is that people often try electricity when everything else has failed. Thus in many cases the disease has become chronic.

This little book deals briefly with the most general forms of application. Those who intend taking the work up seriously could not do better than read the works of Prof. Leduc, "ELECTRIC IONS," Dr. Lewis Jones "MEDICAL ELECTRICITY," and others.

CHAPTER IV.

TREATMENT BY THE CONSTANT CURRENT.

Galvanisation, Cataphoresis & Ionisation.

There are a large number of complaints which may be treated and the results obtained in many are astonishingly good. When carefully employed, no harm can arise even if no lasting benefit can be obtained. There are very many reports extant showing the success that has attended the electrical treatment in such conditions as ANCHYLOSIS, LOCOMOTOR ATAXY, GLEET, HÆMORRHOIDS, INFANTILE PARALYSIS, RHEUMATOID ARTHRITIS, RHEUMATISM, WARTS, RODENT ULCERS AND VARIOUS DISEASES OF THE URINARY ORGANS.

General instruction for the treatment of these troubles will be found on pages 101 to 107.

The various methods of applying the constant current are by means of

Electrolysis,
Cataphoresis,
Ionisation,
Galvanisation,
Direct Application and
General Electrolization.

These methods may all be employed by means of the various types of batteries illustrated and all methods are briefly described under their various headings as follows:—

Electrolysis.

Probably the most striking effect of the direct current is the electrolytic action. This is used by many surgeons for causing destruction of tissue in a simple manner.

During transit of the current, the chemical bodies are freed at the poles. The action differs at the two poles. If we consider for example the removal of hairs, one can easily see the effects of this operation. If the operation is performed correctly the effect is *confined to a very small area* and after the hair is removed practically *no scar* remains. If the needle is used on the positive pole a black scar will result.

Electrolysis is also used for the destruction of Nævi, of tissues in the Urethra, Rectum, Eustachian tubes, etc.

Cataphoresis.

This is the name given to the method by which dissolved medical agents are conducted through the skin into the body by the aid of the constant current. The dissolved molecules of the electrolyte are taken by the positive pole of the current and conveyed towards the negative pole, passing with the current a considerable distance.

This method is now being very considerably used and with wonderful success.

It is important to note that the electrode used should be of a *non-corroding* material, such as carbon, glass, etc., and well covered with a saturated pad of wool.

Some people make no distinction between the treatment known as cataphoresis and that known as ionisation. There is not a great difference; but it might be well to remember that with the former method neutral salts are introduced, while with the latter the salts used are those in a certain electrically charged state.

Ions are Salts formed by the union of metal with an acid radical.

Ionisation.

The value of Ionic medication is conceded and if the general practitioner will realize what it may mean to him both from a professional and practical point of view, we are certain that he will pay the necessary amount of attention which this branch of treatment undoubtedly deserves. The amount of sound work which may be accomplished for a small initial expenditure places it within the means of all. Where one's house has the electric supply laid on, a switchboard with the necessary accessories is all that is required. If there is no electrical supply at hand, a constant current battery of about 24 cells with a galvanometer and current collector is equally efficient. In both cases a few pounds covers the outlay.

It must be remembered that treatment by means of Ionic medication has passed the embryonic stage, although much remains to be done and will be done with further investigation. Enough however has been proved to warrant the strong recommendation we give to the general practitioner to include it in his every-day work. It will help him, it will help his patient and it will increase both his reputation and his practice. It costs little and its employment presents no difficulties. We mention here but a few of the many complaints which yield to ionic treatment. Hæmorrhoids, rodent ulcers, boils and carbuncles will certainly yield to it; warts will disappear, neuasthenia, neuralgia, &c, may be treated with a considerable amount of success, and good results have been obtained in cases of ringworm.

Ions containing positive electricity pass to the negative pole. Those charged with negative electricity pass to the positive pole.

The electrolyte is the solution conducting the electric current.

The positive pole conductor to the electrolyte is called the Anode and that leaving it the Cathode. While the current is passing in an electrolyte the acids or acid radicals and bases are set free near the Anode, moving in the electrolyte from Cathode to Anode, which is *against* the flow of current.

The metals and metallic radicals go *with* the current and free themselves at or near the Cathode.

The name Ions was given by Faraday to the constituents of the electrolyte set free at the electrode by the current.

Anode anions are those freed round the anode and those freed round the cathode, kations.

Galvanization or Direct Application.

The term Galvanization or Direct Application refers to the direct application of the Constant Current to the nerve centres or to any special part.

The method of application is very simple. In such cases as Neurasthenia, the patient holds the positive electrode and the negative electrode is applied directly upon the nerve affected. The electrodes are of metal, covered with lint saturated in a solution of salt water.

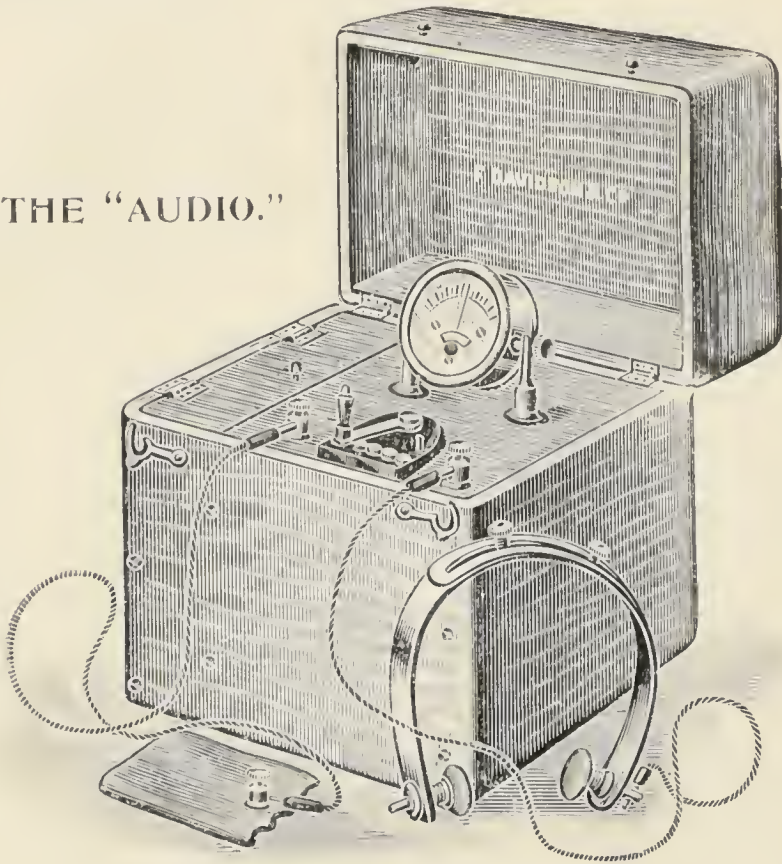
A number of troubles can be treated in this way and it is generally spoken of as Galvanisation or Direct Application of the Constant Current, and is only used when it is not necessary to use drugs as in Cataphoresis or Ionisation, but when one wants to use Electricity pure and simple.

CHAPTER V.

Medical Batteries.

These are often called Constant Current or Galvanic Batteries. They are made up of a varying number of dry cells, each of $1\frac{1}{2}$ volts capacity, connected up in series and contained in strong polished oak boxes.

THE "AUDIO."

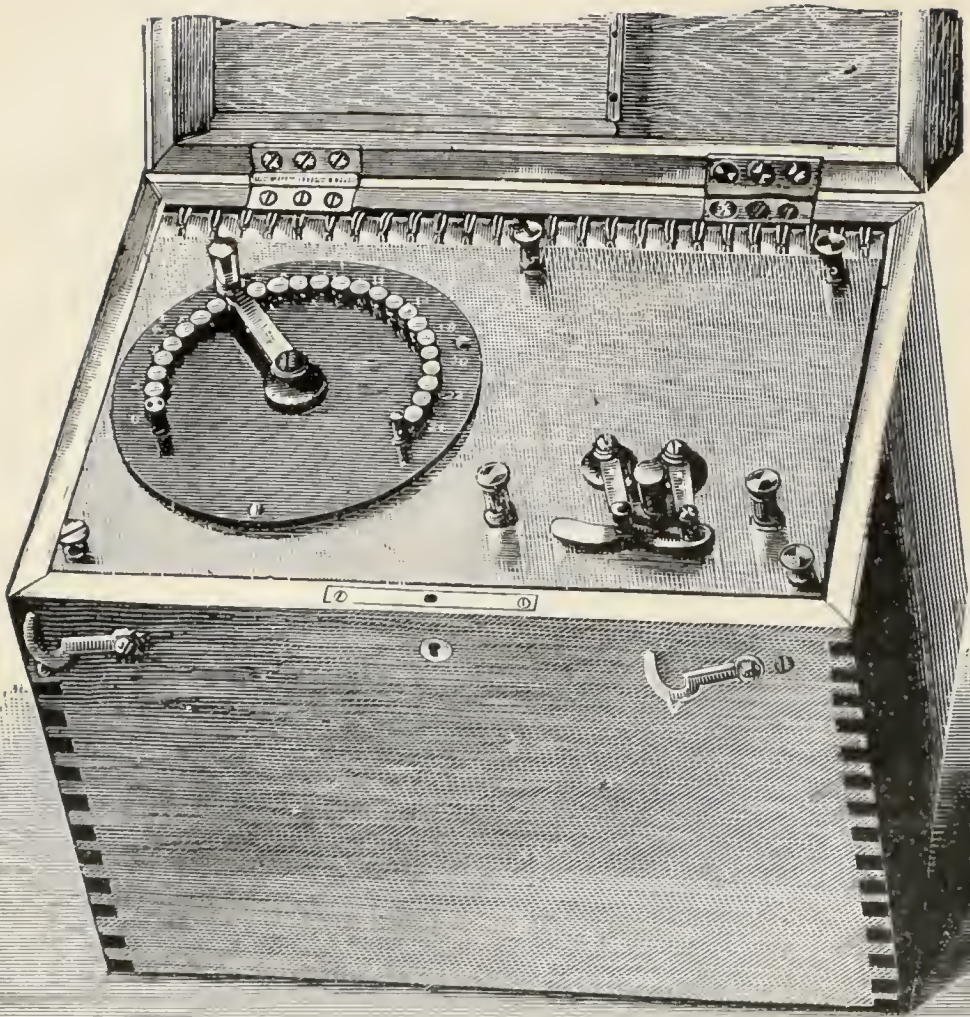


No. 33 B. Fig. 3.

For the treatment of auditory nerve deafness. This consists of a battery of cells fitted in polished mahogany box with galvanometer, volt selector, terminals, aural electrodes and cord, back pad and cord. The battery is made specially for the treatment of deafness.

Constant Current Batteries.

The most useful sizes have from 18 to 40 cells and have, as will be seen from the illustration, a cell collector mounted on an inner lid, whereby one is enabled to bring into use one cell at a time. The collector makes contact with the next cell *before breaking contact with the last*, so that shocks are avoided. The terminals for the connecting cables are marked with the signs “+” positive, and “—” negative. There is also a current reverser, which is distinctly marked “R” and “N,” to indicate the flow of the current from the terminals, viz: When the reverser switch is over on the “N” side, the current is flowing in the normal direction—that is to say, the terminal marked “+” transmits the positive pole of the current and the “—” terminal the negative. When the reverser switch is moved over to “R,” the terminals have changed poles, the “+” becomes the “—” and vice versa. A galvanometer is also fitted. A suitable number of electrode pads, handles, and cords are contained in the lid box. Some of these batteries are also fitted with a small coil for the Faradic current and these are termed Combined or Universal batteries (see illustration). With these batteries much useful work may be done.

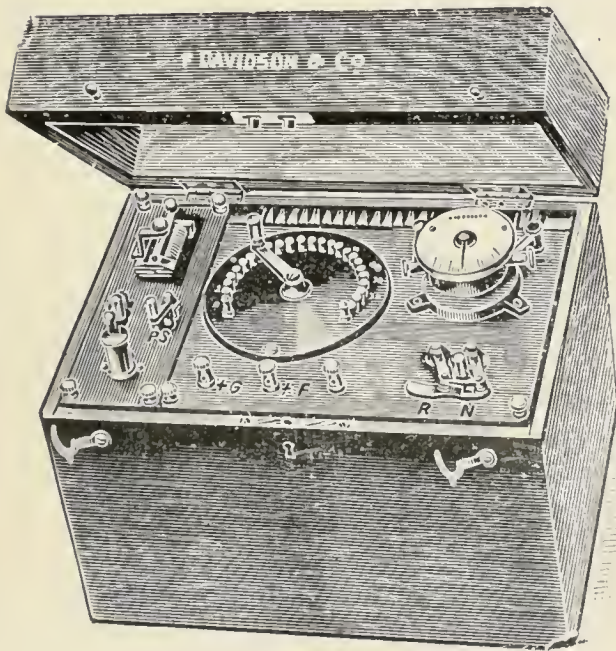


No. 34 A. Fig. 4.

Battery of 24 cells fitted with cell collector, current reverser, place for galvanometer and marked terminals. In the lid box are handles, cords and four electrodes. The box is made of polished oak. Much good work may be done with this battery.

CONSTANT CURRENT AND FARADIC BATTERY.

(Universal)



No. 36 D. Fig. 5.

Battery of 24 cells fitted with cell collector, current reverser and galvanometer, coil for faradisation, terminals marked. In the lid box are electrodes for galvanisation, electrolysis, cataphoresis, and for auditory nerve deafness, forceps and needle holder for epilation. A very complete and useful battery enabling one to do most simple forms of treatment.

CHAPTER VI.

Directions for using Constant Current and Universal Batteries.

Before using these batteries, care should be taken that all moveable parts, namely Cell Collector, Current Reverser and Terminal Screws, etc., move smoothly and make good contact.

To enable one to judge if these parts are in order or not, it is wise to test by means of a voltmeter, providing there is not a milliamperèmeter fitted. If, when the cell collector is moved round over each stud, the needle of voltmeter drops to zero and *then* records the voltage at the terminals, it shews that contact is not good between that stud and arm of cell collector. This is easily adjusted, it often being only necessary to tighten the screw in centre, so that the small connecting strip of metal underneath arm presses firmly on each stud. If this is done there will be no jerky and painful results felt by the patient when the cell collector is moved over each stud.

While these tests are being made, one may easily try the connections of the current reverser: If these are good the needle of voltmeter will at once drop to zero, or go over on the opposite side when the arm is moved over to "R" or reverse side—thus shewing that the flow of the current is in the reverse direction and that the contact is also good.

If a galvanometer is fitted to the battery, this should be removed and the terminals for same may be connected together by means of a piece of wire.

If the galvanometer were not removed, it would be badly damaged by too much current passing when the terminals are shorted by the voltmeter.

It now being taken for granted that everything is in proper working order proceed as follows:—

Application of Direct Current—Connect the positive (+) cable to the terminal marked + and the negative (—) to that marked —; this being done, attach to electrodes. Supposing the case to be treated be one of warts, the positive electrode will be of metal having a pad of wool saturated with a solution of magnesium sulphate (say 20 grammes to the ounce). This pad will be placed on the wart and kept there pressed fairly tightly; the negative (—) electrode pad saturated in a solution of salt water may be placed on any convenient part of the patient's body.

This done, the operator will very gradually move the cell collector from stud to stud until the required strength is reached. This will be recorded on the galvanometer.

The current should be between six and seven milliampères and should be given for about ten minutes. When this time has elapsed the operator will again move the cell collector gently back. By so doing the patient does not receive a shock of any sort. The electrodes may then be removed, the wool pads thrown away and the electrodes dried. It is wise to disconnect the cables and thus avoid any chance of their being placed together, as in the event of the collector not being at stud marked zero, a short circuit would take place and the cell would in time become exhausted.

If the battery be of the Universal or Combined type, the same procedure holds good for the Constant Current part, but one will have to test the Faradic Coil in addition. This is easily done in the following manner:—

It must be noted (1) that the starter which is marked “on” and “off” makes good contact, (2) that the hammer or plate break is making the correct number of interruptions, (3) that the studs marked primary and secondary also make good contact, (4) that by withdrawing and inserting the metal core, the strength of the current is regulated. Having attended to these details and having ascertained that everything works correctly, proceed as follows, it being remembered that the uses to which the Faradic

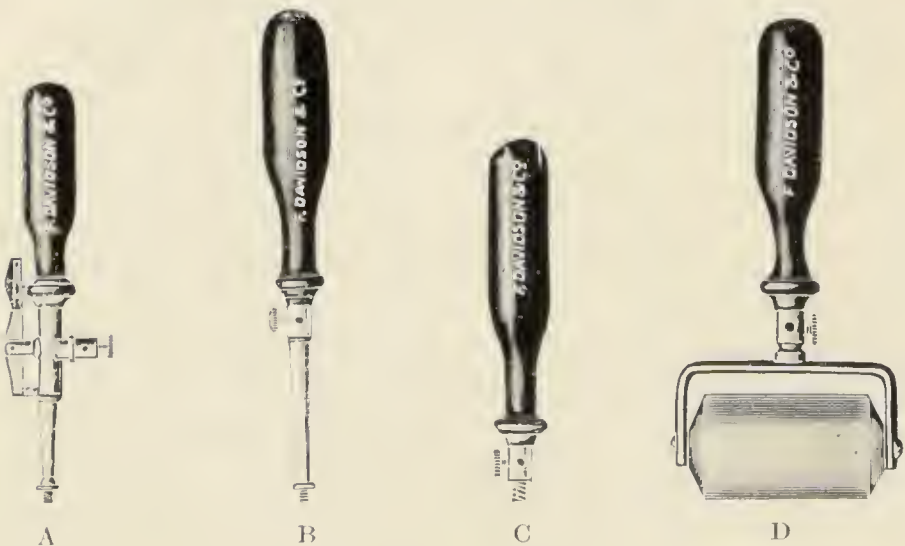
Current should be applied, namely for the stimulation of muscles and ligaments and for its beneficial effect on the intestines and checking the degeneration of the organs generally.

Attach the cables to the terminals marked "F" and at the other end of same attach the metal handles and pads. These should be given to the patient to hold or affixed to the patient's body on the part to be treated.

The operator now withdraws the metal core and switches on the starter, gradually pushing the core home again to increase the current. This in most cases should not be made uncomfortably strong. This application may be given for from five to fifteen minutes. The current should be diminished before switching off by withdrawing the core.

CHAPTER VII.

HANDLES, ELECTRODES, ETC.



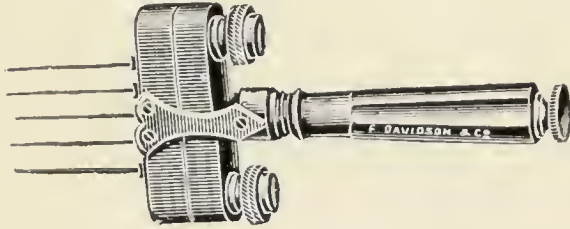
No. 36. Fig. 6.

A, Interrupter. B, Long Stem. C, Short Stem. D, Wheel Electrode.



No 37. Fig. 7.

Simple and light needle-holder to take needles of various sizes.



No. 38 Fig. 8.

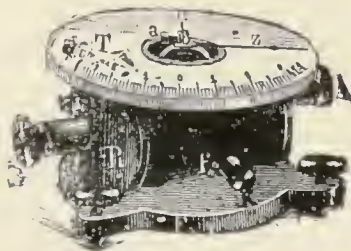
Dr. Lewis Jones's Multiple Bi-polar Needle-holder for the treatment of Nævi.



No. 39. Fig. 9.

Collecting electrode for epilation.

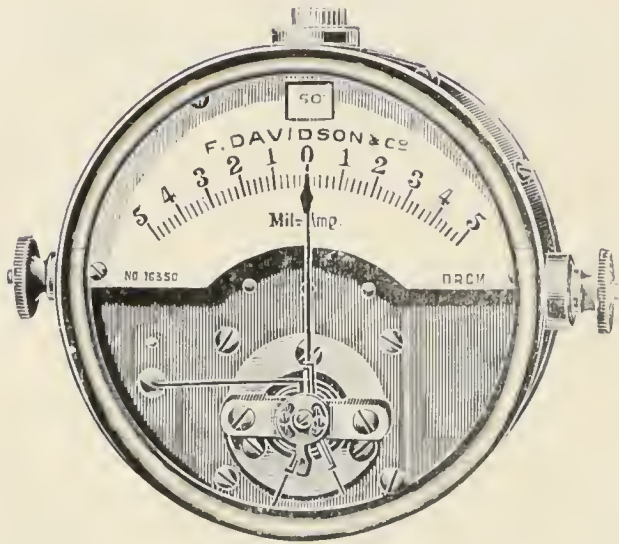
GALVANOMETERS.



No. 16 A. Fig. 10.

Dr. Edelmann's Galvanometer, reading up to 30 milliamperes in single milliamperes.

D'ARSONVAL GALVANOMETER.



No. 75 B. Fig. 11.

Dead-beat. This may be used in any position and reads from five to two hundred milliamperes.

NOTE.—This type of milliamperemeter is the latest and most convenient type, for it can be used in the horizontal, vertical, or any other position and its reading is not affected even when used near a dynamo. Care must be taken that a very strong current is not short-circuited by placing the electrodes together. If this happens, the fine hair spring through which the current passes is affected and the index needle will not point to “0” any more.

CHAPTER VIII.

SWITCH BOARDS WITH RHEOSTATS

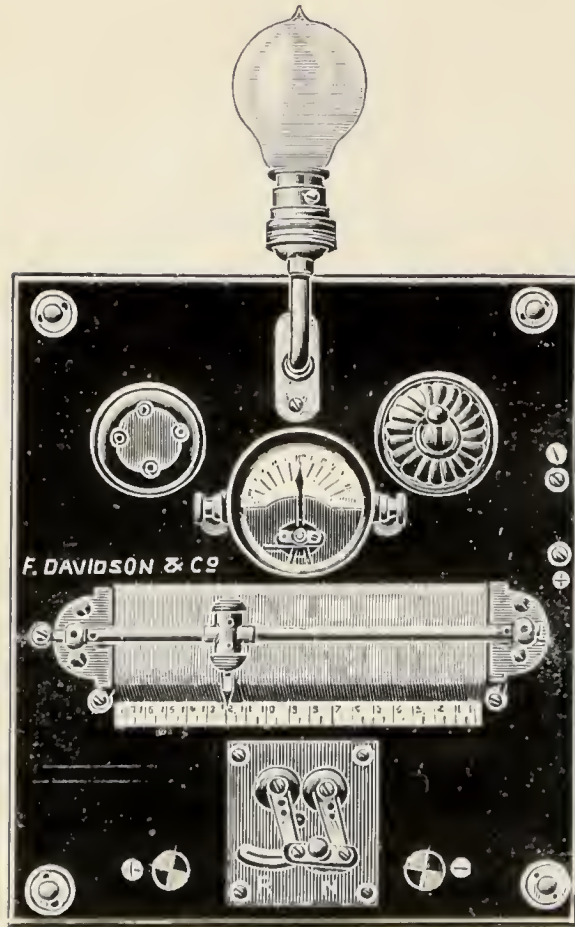
for use on the main house supply.

For the various methods of Constant Current Application as enumerated on pages 21 to 23 for use with constant current batteries.

There are many very useful designs of switch boards and switch tables for this purpose.

The general construction is in most cases the same. The simple Switch-board illustrated, No. 201, is made up in the following manner. The board itself is of polished slate and mounted on this is a lamp bracket to take the guide lamp; plug socket for the entry of the wires leading from the house supply; switch for controlling the current; wire resistance or volt regulator; current reverser; galvanometer and terminals marked “+” and “—” for the electrode cables. To this may also be added a second lamp and sledge coil for faradisation. Fig. 13, illustrates a switch-board for galvanisation (catephoresis, etc.), illumination of surgical lamps of any voltage and cautery from an accumulator wired in conjunction with board.

SWITCHBOARD.

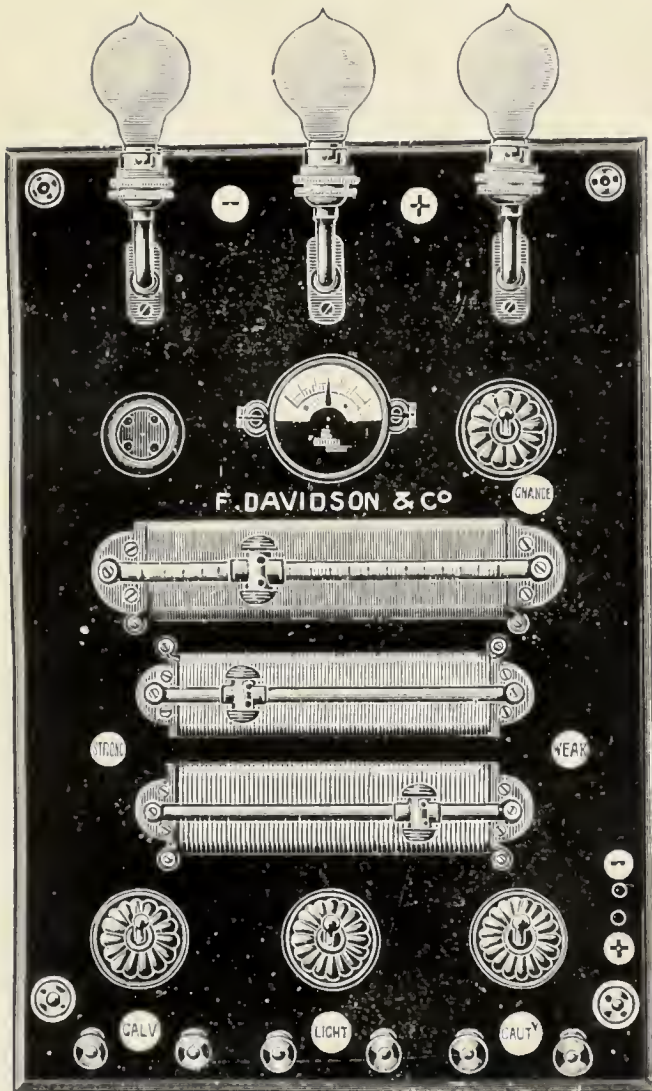


No. 201. Fig. 12.

For galvanisation, cataphoresis, electrolysis, ionisation, etc., on constant current main.

Board of polished slate fitted with lamp, cut out, switch for controlling entry of main current, adjustable resistance, galvanometer, current reverser and terminals. The current available is from 0.1 to 70 v.

SWITCHBOARD.

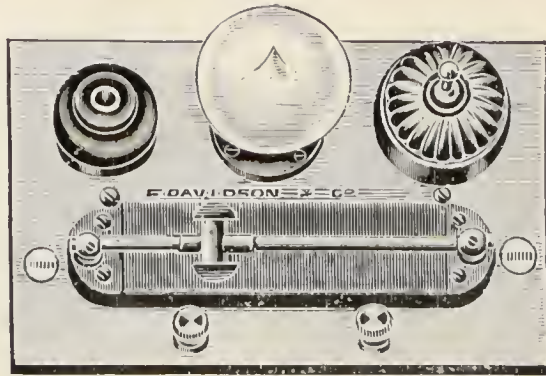


For the illumination of all sizes of surgical lamps, galvanisation, electrolysis, cataphoresis, ionic medication, etc.

Cautery from an accumulator wired in conjunction with switchboard.

The board is of polished slate and fitted with three lamps and an adjustable resistance with controlling switch and terminals all marked, for the illumination of surgical lamps. The centre lamp is used in conjunction with the adjustable resistance for galvanisation, and terminals and switch are marked for this purpose. The adjustable resistance marked "Cautery" is used in conjunction with an accumulator, and a switch controls the entry of the current. The galvanometer is used in the circuit for the galvanic current. There is also a cut-out and main controlling switch. The terminals are all marked. The whole has a very handsome appearance and is of great utility.

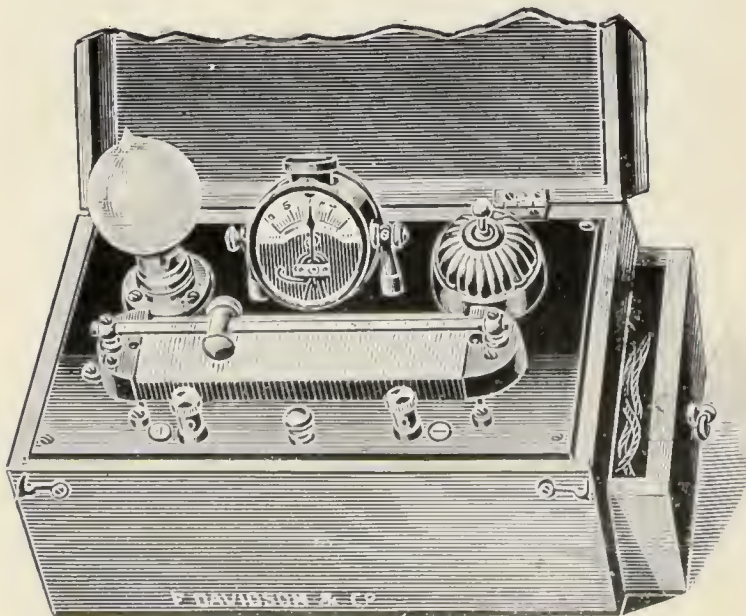
PORTABLE SWITCHBOARDS



No. 200. Fig. 14.

For galvanisation, electrolysis, cataphoresis, ionisation, etc., on constant current main.

Small board of polished slate fitted with lamps ; plug for entry of main, switch for controlling same ; adjustable resistance and terminals for transmission. The current from the terminals may be increased from 0.1 gradually, up to 70 v.

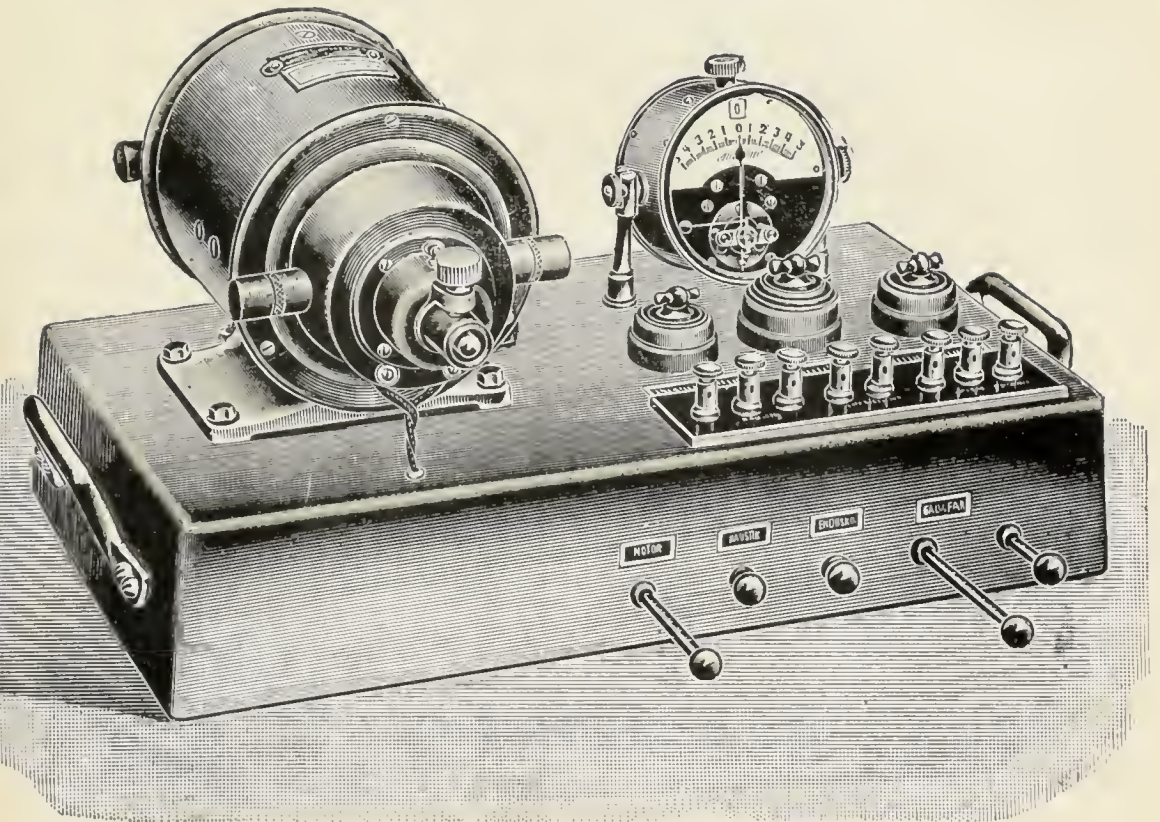


No. 202. Fig. 15.

For galvanisation, electrolysis, cataphoresis, ionisation, etc. In polished oak or walnut case with lamp, switch, galvanometer, adjustable resistance and terminals. A drawer is provided for the electrodes. The size is only 8" x 13" x 9", and weight about 15 lbs.

CHAPTER IX.

PANTOSTAT.

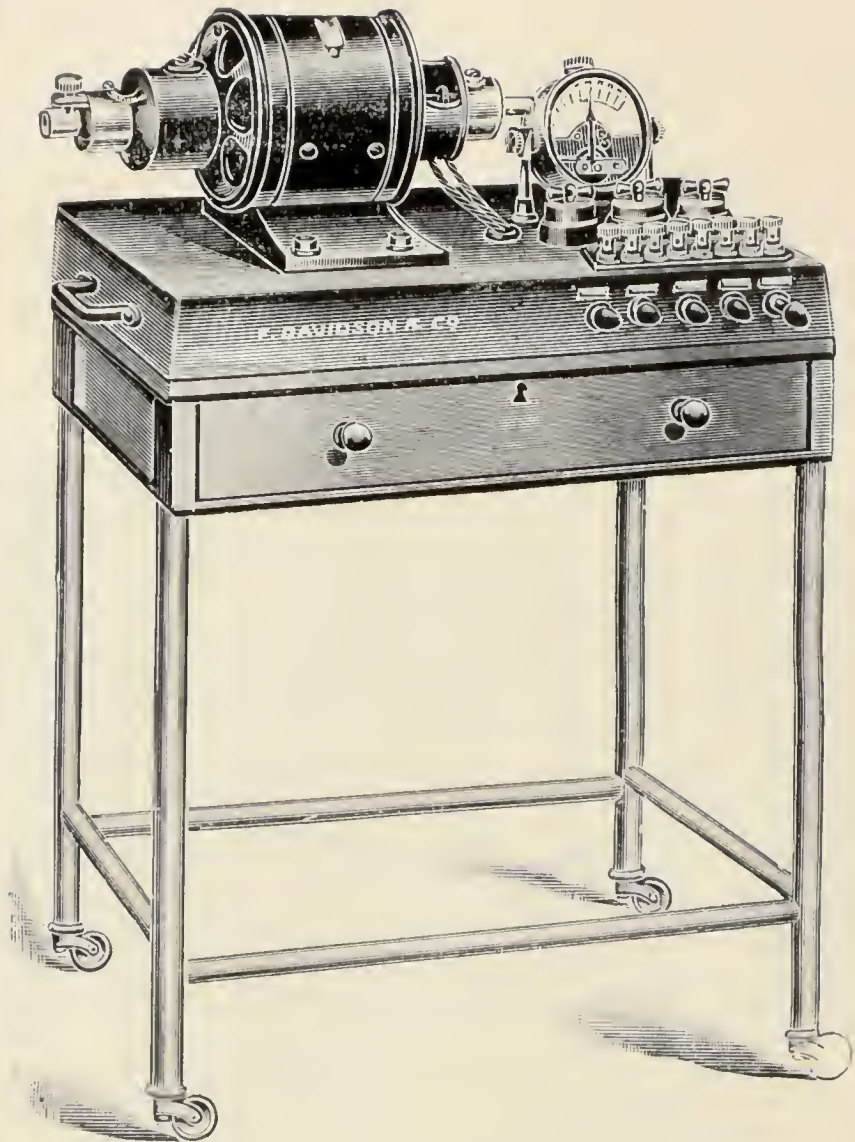


No. 250 A. Fig. 16.

A Universal Apparatus for using the current from the main for Cautery, Surgical Lamps, Galvanisation and Electrolysis, Sinusoidal Faradisation; for Rhythmic Currents and for Leduc's Currents; for Air Pumps, Hot-Air Douches, Massage, and rapid Vibration; for surgical operations with drills, trephines, burrs, circular and straight saws, etc.

All the currents are transformed; it is therefore impossible for patient or operator to receive a shock while using this apparatus, even if one pole of the dynamo is connected to earth.

A condenser is provided in the circuit for galvanisation, to neutralize the pulsations of the dynamo.



No. 250. Fig. 17.

These Motor Transformers were brought out in London in 1903. We have the conviction that they are the most useful electro-medical apparatus which has been constructed up to now, because they supply *all* the various currents and motive power which are required nowadays in medical and surgical practice, with the only exception of X rays and High Frequency Currents. On account of their great convenience they are being already used by a large number of Hospitals and medical men.

We guarantee our instruments for one year, i.e., should any defect due to imperfect material or workmanship be discovered within a year, we undertake to make it good, free of charge. Although nearly 250 of these instruments have been in regular daily use, some of them since 1904, none has required any serious repairs up to now, which is the best proof of good design, materials, and workmanship.

The motors consume less than one ampère on a 200 volt continuous current supply, and can be attached to any wall plug or lamp holder without altering the size of the cables and fuses.

The terminals are mounted on an ebonite plate, on which the words : Cautery, Light, Galvanisation, Faradisation, are engraved, so that no mistake can be made in connecting the cords.

The Apparatus consists of a motor 1-eighth of a H.P. mounted on a base of cast iron, which contains 5 variable rheostats ; one of these controls the speed of the motor, the 4 others vary the strength of the circuits for cautery, surgical lamps, galvanisation, and sinusoidal faradisation.

The sliding contacts of these rheostats can be moved either by the steel rods (as shown in No. 250), which have to be drawn out to increase the strength of the current, or by cranks fitted with large ebonite knobs, which have to be turned round. We can supply either type : As far as gradual increase or decrease of the current-strength is concerned, both are equally convenient ; but we consider the rods preferable because the apparatus can be dusted and kept clean more easily, and moreover, the cranks may be left by mistake on "strong," whereas it is less likely that it will be forgotten to push the sliding rods home to "weak" after the application is over.

For Cautery, Surgical Lamps, and Sinusoidal Faradisation, the motor converts the continuous into an alternating current, which is transformed by means of an alternating current transformer so that at the secondary terminals of this transformer about 36 ampères and 10 volts are available for cautery, and 2 ampères and

20 volts for surgical lamps. Two sliding rheostats control these circuits, so that any size cautery burner or surgical lamp may be used.

To supply the current for Galvanisation, Electrolysis and Cathoporesis or Ionic Medication, the motor is provided with a second winding, so that it acts also as a dynamo. The current which reaches the patient is therefore not connected at all with earth or with the current supplied by the main, and our pantostats can safely be used for applying currents, even in a bath, without fear of exposing the patient to the dangers of a shock, which would be possible if the current from the main were used directly in a bath.

The terminals of the special wire for galvanisation are connected with a volt selector, which enables us to vary the voltage gradually from 0.1 up to about 70 volts; the current passes through a reverser, and a dead beat milliampèremeter indicates the current reaching the patient. The M.A. meter is provided with two shunts and indicates up to 5 M.A., every tenth part of a M.A.; from 5 to 50 every single M.A.; and from 50 to 500 ten by ten M.A. A condensator is provided in this circuit to neutralize the pulsations of the dynamos.

For Sinusoidal Faradisation the transformed alternating current passes through a similar volt selector. Sinusoidal and continuous currents may be used combined.

For alternating circuits, the pantostat is provided in addition with an alternating motor, to drive a continuous dynamo which supplies the various currents as described above.

If no current from the main is available, 6 Accumulator Cells, of about 50 ampere hours capacity, may be used to drive a 12-volt motor; this is coupled to a dynamo giving about 100 volts and $2\frac{1}{2}$ ampères, and this current is used for cautery, light, galvanisation, etc., as described above.

Drills, Trephines, Circular Saws or the various appliances for massage, hot-air douches, etc., are connected with a flexible shaft

which has to be attached to the motor.

Air Pumps for Pneumatic Massage, or for compressing air ; the Rhythmic Interrupter or Leduc's Interrupter, etc., can be attached directly to the axle of the motor.

Explicit directions for use are sent with the apparatus.

Directions for Use of PANTOSTAT.

The apparatus has to be connected with a wall plug or lamp holder. Before doing this, see that all the knobs are pushed home. The bearings of the motor have to be kept oiled ; but no oil is to be put on the collector or the brushes.

The motor has to be started whenever the apparatus is to be used.

For cautery, light, and faradisation, the switch marked "Primary" has to be turned on. For galvanisation, the switch marked "Galvan," has to be turned on.

Cautery.—Connect the cords with the terminals marked "Cautery." If a platinum burner is to be used, they should be connected with terminals marked "2." For a porcelain burner or a loop, they should be connected with terminals marked "1." Start the motor by drawing out the rod marked "Motor," turn on the switch marked "Primary" and increase the strength of current by pulling out gradually the rod marked "Cautery," till the platinum attains a yellow heat. When the operation is over, stop the motor by pushing the rods home. Eye, nose or throat burners, requiring from 8 to 30 ampères, may be used.

It is important that the rod marked "Motor," should be drawn out as far as it will go, and that the strength of current for cautery burners should be regulated by the rod marked "Cautery," and not by the rod marked "Motor."

Surgical Lamps.—Connect the cords with the terminals marked "Light," start the motor by pulling out the rod marked "Motor," turn on the switch marked "Primary," and increase the

strength of current by pulling out gradually the rods marked "Light," till the lamp gives a bright light.

Galvanisation, Electrolysis, or Cataphoresis —Connect the cords with the terminals marked + and — above Galvanisation. Soak the electrodes in warm water, turn on the switch marked "Galvanic," start the motor by drawing out the rod marked "Motor," and apply the electrodes to the patient. Pull out the rod marked "Galv." gradually, till the M.A. meter indicates the desired strength of current.

The M.A. meter is provided with two shunts. As long as 5 is visible on the dial, it indicates every tenth part of a M.A. up to 5 M.A. While 50 is visible, it indicates every single M.A. up to 50 and while 500 is visible, it indicates up to 500 M.A., 10 by 10.

The switch marked "N.R." is a current reverser. Test by means of pole-finding paper whether the signs + and — are correct while the handle of the switch connects N N (normal). R R means reversed. After the application is over, turn the current off by switching off the switch marked "Galvanic," and by pushing home the rods marked "Galv." and "Motor."

Sinusoidal Faradisation.—Connect the cords with the terminals on the right-hand side marked "Faradic," and soak the electrodes. Start the motor by drawing out the rod marked "Motor." The greater the speed, the higher is the number of periods or reversals, and vice-versa. Turn on the switch marked "Primary" and apply the electrodes to the patient. Draw out gradually the rod marked "Farad," on the right-hand side, till the desired strength of current has been reached. When the application is over, push the rods marked "Farad." and "Motor" home.

For Combined Galvanic and Faradic Currents,—connect the cords with the terminals on the right-hand side, and with the terminal above Gal. +, and regulate the strength of current for galvanisation and faradisation as described above.

Leduc's Interrupter, and Lewis Jones' Rhythmical Interrupter have to be attached to the motor.

Air Pumps, for pneumatic massage for the ear, etc., are attached to the motor. Start the motor; the quantity of air which is compressed with each stroke of the piston can be varied by the screw on the air pump. The number of strokes can be varied by the speed of the motor.

Massage or Rapid Vibration.—The flexible shaft with the vibrator, etc., is connected with the motor.

Drills, Burrs, Trephines, etc., are connected with a hand piece which is attached to the flexible shaft and the latter is connected with the motor.

CHAPTER X.

DESCRIPTION OF INDUCTION COIL.

Faradic Current.

This type of current is invaluable for the stimulation of muscles and ligaments. Its effect upon intestines is that of giving strength to enable them to withstand or check undue degeneration.

A simple form of Induction Coil consists of a coil of wire insulated and wound round a bobbin with a soft iron core fitted through the centre and arranged with an interrupter. When this coil is connected to a battery, the current passes through the interrupter; as this interrupter comes in contact with the core, the current is made and when the interrupter leaves the core the current becomes broken. In other words the current is periodically established and interrupted in the winding of the coil. The magnetic field of the coil is made to vary with each make and break of contact. Currents are thus induced in the winding of the coil.

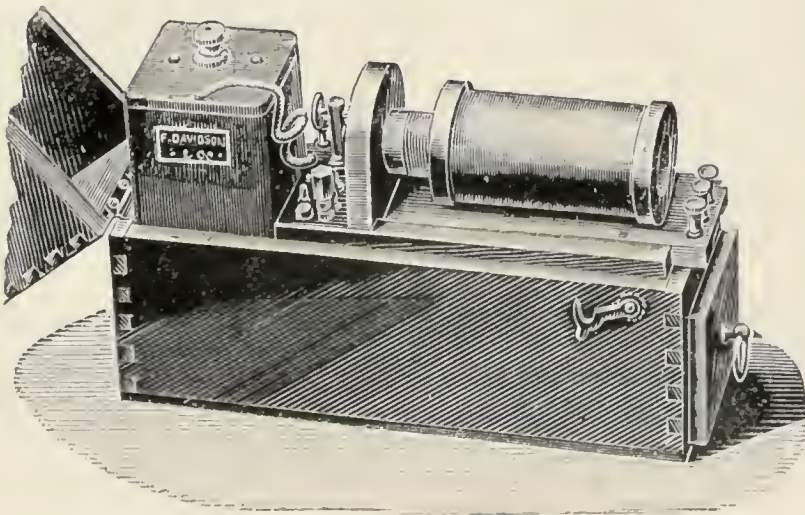
The current at "make" may be lead off and constitutes what is termed the Primary Current. It is in no way connected with the

battery current and is made up of a series of waves passing in one direction and corresponding in frequency with the interruptions of the battery current. The waves are due to the sudden rise and fall of the electromotive force in the wire.

The Secondary Current is obtained from an entirely independent winding ; but being in the same magnetic field as the Primary it also becomes affected ; but not quite in the same way. In this coil there is an induced electromotive force corresponding to an opposite electromotive force. As one falls the other rises. The secondary is often spoken of as Alternating. In both cases the E.M.F. becomes far greater than that of the battery which supplies the energy in the first place. Simple coils are here illustrated.

FARADIC BATTERIES AND COILS.

Lewis Jones' Coil.



No. 76.

Fig. 18.

This coil is fitted in sledge form and is a most useful size. It is worked from one large dry cell, which will work the coil for about 80 hours altogether. A drawer is fitted underneath the coil for the electrodes (cords, handles and five electrodes).

No. 31.

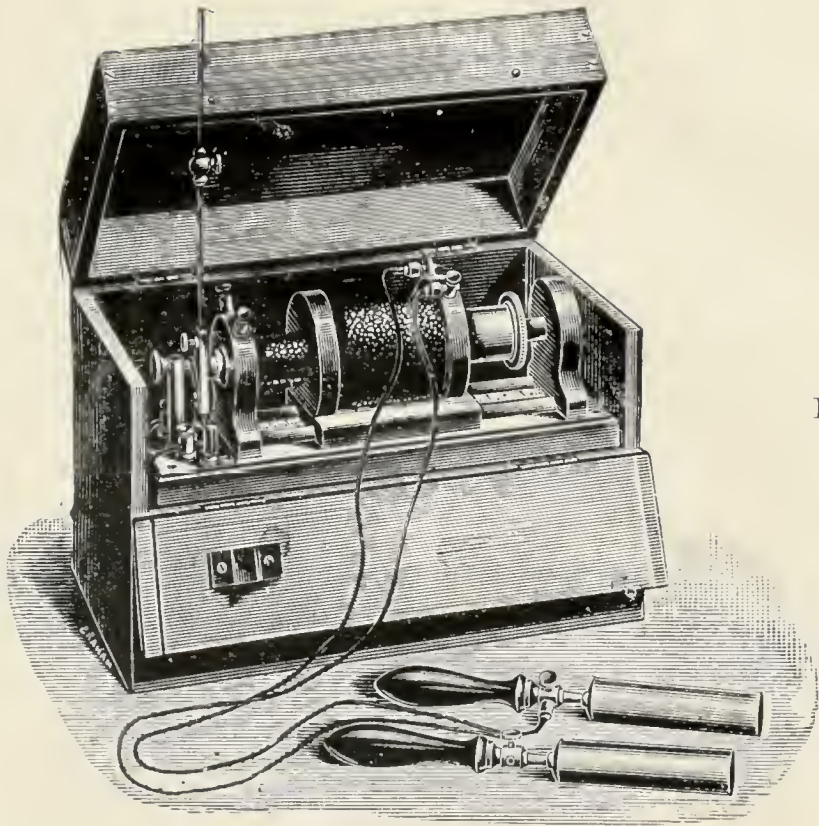


Fig. 19.

Powerful coil fitted with adjustable interrupter, having a drawer for electrodes as in No. 76 Coil.

CHAPTER XI.

GENERAL ELECTROLIZATION.

Dr. Schnee's Four Cell Bath.

By the introduction of this method of general electrolization a great deal of trouble has been saved, not only for the Doctor ; but also the patient. In the first place the patient need not undress for treatment, and in the second, large currents may be given without fear of shock to the patient. The water in each bath forming the actual electrode, it will be at once understood that as the limb is completely and perfectly brought into contact with

the current through the water, no fear of electrolysis or painful doses exists. The currents may be directed in many ways and the bath may be used as a single arm bath, or as a complete body bath, *i.e.*, for both arms and both legs. By means of a suitable commutator the current is made to flow from one arm to one foot bath and vice versa, or from both arm baths to both foot baths or from one of each and so on. It has been found extremely useful and is accepted as a very handy and efficient apparatus.

There are a number of accredited makers of this bath in England and all are much the same.

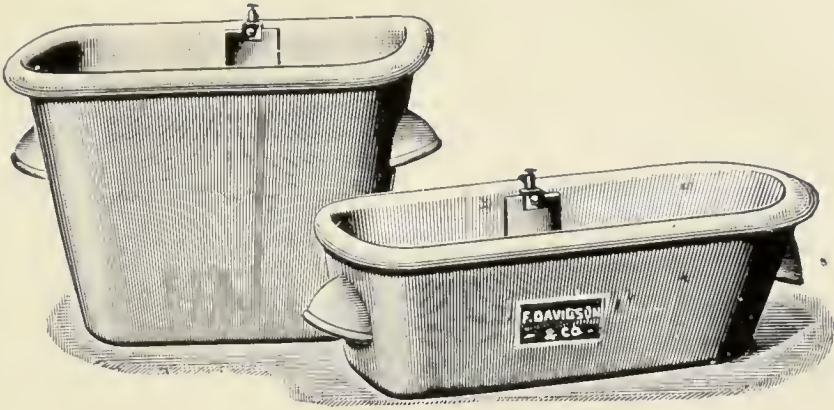
The apparatus necessary for one to give this form of treatment consists of Switchboard for Galvanisation, Faradisation and Sinusoidal Currents with Milliampèremeter, Current Reverser and special Commutator to control the direction of flow of currents into each bath.

Four porcelain baths, two to take the arms and two the feet. These can be arranged so that the patient can sit comfortably on a chair and rest his arms in the baths for this purpose and place his feet in those for same. The electrodes placed in each bath are generally of carbon and connected direct by means of wires to the switchboard.

It might be well to mention here that the currents necessary for the successful administration of this bath can be obtained in a very perfect way from the Universal Apparatus described on page 37 to 43.

There are other forms of applying general electrolyzation; but Dr. Schnce's 4 cell bath is undoubtedly the most reliable and satisfactory from every point of view. It has practically superseded all other methods.

FOOT AND ARM BATHS.



Nos. 74 and 74 A. Fig 20.

For the treatment of gout, etc., by means of cataphoresis. Each bath has an electrode of carbon with terminal attached for wires.

CHAPTER XII.

X RAYS.

In the month of December, 1895, the scientific world was startled by the news of a discovery made by Professor Roentgen of Wuertzburg. Whilst experimenting with Crooke's tubes, he found that from these tubes rays emanated, which, though invisible to the eye, acted like ordinary light on photographic plates and were able to penetrate substances through which ordinary light could not pass—such as wood, flesh, etc.; whilst substances like bones or metals were less transparent or quite opaque.

Since this date, other scientific men have proved beyond a doubt how important this discovery is as an aid to surgery and its proved utility is recognised by the interest taken in this comparatively new science by the whole medical scientific world. Its use for diagnosis and curative effects in many skin diseases has made it of even more universal value.

The apparatus required to produce X Rays consists of Spark Coils, Transformers or Static Machines, Focus Tubes and Fluorescent Screens.

The Spark Coil.

The essential parts of a Spark Coil are: The Primary Coil, the Iron Core, the Secondary Coil, a Condenser, and lastly the Interrupter.

In addition, a Commutator and Discharging Rods are often required.

The Primary Coil

is made of three or four layers of insulated copper wire about $5 \frac{m}{m}$ thick. Often these layers are arranged so that they can be either connected in series, in groups, or in parallel. If in series, the current travels round the iron core as frequently as there are turns of wire and causes a high self-induction. If the layers are connected in parallel the self-induction is low. If connected in groups, it is half way between the two mentioned, thus showing how the primary coil may be altered.

The Iron Core must not be made of solid iron, because it would accept and lose magnetism too slowly and become heated.

A number of thin sheets are used for the core, each insulated from each other. The core is covered by linen tape and the primary wire is then wound round.

The Secondary Coil

consists of many thousand turns of copper wire of $\cdot 18$ to $\cdot 20 \frac{m}{m}$ thick, doubly covered with silk and wound in vertical sections, numbering from 100 to 200, each less than $\frac{1}{16}$ th of an inch thick.

The primary coil and core are put into a tube of ebonite about one inch thick to insulate them from the secondary. The secondary is drawn through a mixture of melted paraffin wax and resin, before it is wound on the coil. Each section is also waxed.

The spark length is governed by the number of turns on the secondary wire. In the secondary coil, currents are induced on making or on breaking the primary current.

When we say that a coil gives sparks of a certain length, we mean those produced on breaking the current.

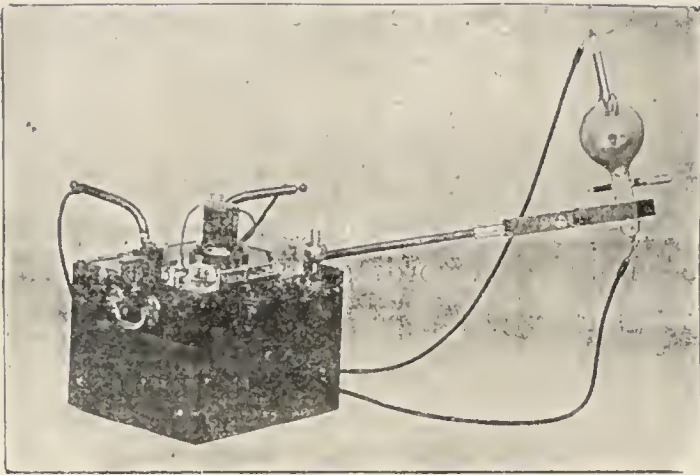
Coils are classified according to their spark length only. Roughly speaking, a 12" spark requires a current of about 150,000 volts. The effect produced on a fluorescent screen or photographic plate depends on the number of milliamperes discharged through the focus tube. One therefore requires a large current to overcome the resistance of a tube.

The Interrupter.

The object of this important part of a spark coil is to make and break the primary current in quick succession. The intensity of the secondary spark depends upon the intensity of the magnetic field and of the primary current and on the suddenness with which these two disappear.

There are many kinds of interrupters; but electrolytic interrupters are superior to most other forms. Motor mercury breaks are the best. The condenser used for spark coils consists of sheets of tinfoil, insulated from one another by layers of paper soaked in paraffin wax. The spark which appears on the interrupter when the primary current is broken, must be extinguished as quickly as possible. The condenser serves to achieve this end, for when the contacts of the interrupter separate, the current rushes into the primary coil and the battery, etc. In doing this it passes through the primary coil in the opposite direction. This helps to de-magnetise the iron core rapidly.

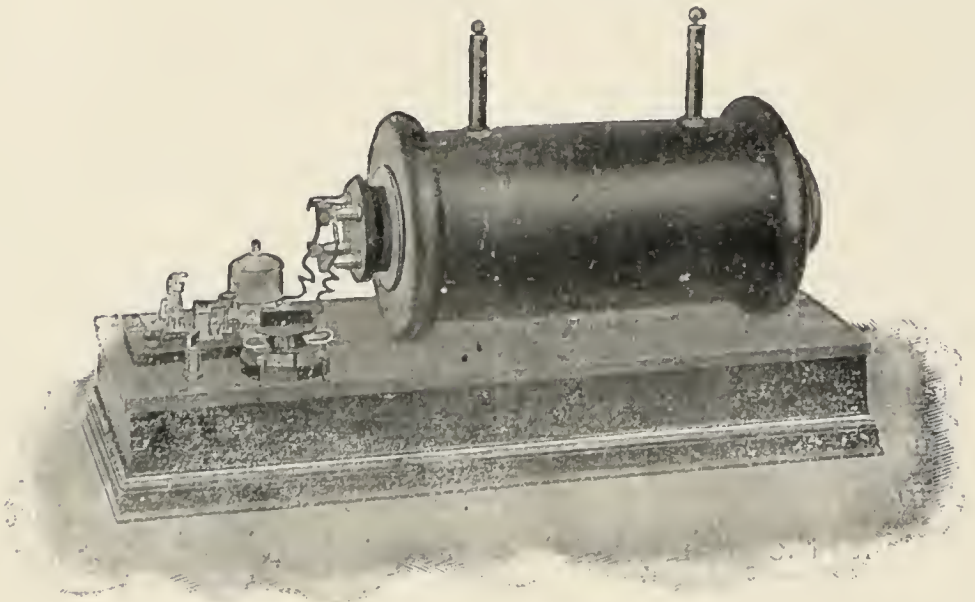
The frequency of the interrupter is of importance. Forty interruptions per second are sufficient; sometimes less answer better.



COIL No. 300. Fig. 21.

Complete portable outfit for connecting to direct main supply.

10" spark coil with sub-divided variable primary, rheostat, switch, fuses, electrolytic interrupter, plug, four yards conductor, focus tube holder with conductors 5' long, one No. 377 X Ray tube, one fluoroscope, strong oak case with handle. With this outfit much good work can be done, including photography.

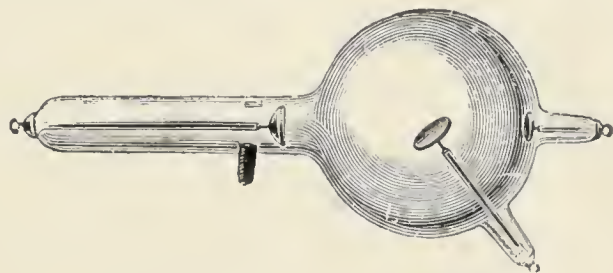


COIL No. 302. Fig. 22.

12" spark coil with three part variable primary, on base containing condenser with switch commutator, platinum interrupter and spark pillars. This coil can be strongly recommended for all work,

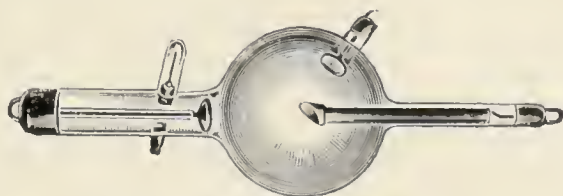
Focus Tubes.

The quality of the focus tube is all-important for X Ray work. It is impossible to do any good work with an inferior tube, even if it is used with the best coil made. If the secondary terminals are connected with electrodes fixed in a highly exhausted glass bulb, the current will discharge itself through the tube rather than in the air. The quality of the X Rays varies with the degree of exhaustion in the tube.



TUBE No. 377. Fig. 23.

With ordinary anti-cathode and palladin for softening (osmosis regeneration), diameter of tube 6".



TUBE No. 378. Fig. 24

With extra heavy anti-cathode attached to an iron tube to dissipate the heat, with palladin for softening, diameter 6". This type of tube is most serviceable and if taken care of, will last a considerable time and give very good results. There are many sizes and kinds of focus tubes, both water cooled and simple. Space does not allow of the illustration of other types.

Dr. Sabourad's Pastilles for timing X Ray exposures. Book of 24 pastilles with pattern pastille of the final brown tint for comparison. Benoist radiometer with twelve divisions complete for screwing on, and Fluorescent screen to enable one to judge of the quality of the rays are all necessary.

High Vacuum or Hard Tube.

The X Rays have a greater penetrating power in a hard tube than in a low or soft tube. In the hard tube the fluorescence is grey-green. In the soft tube the fluorescence is very green.

There are many kinds and makes of tubes. Those we illustrate will be found both reliable and fairly cheap.

A spark gap inserted in series with the focus tube helps to suppress the closing current (before mentioned). Care must be taken to insert it correctly.

Fluorescent Screen

These are made of glass covered with Barium Platino-Cyanide, and should have a lead glass protecting-plate fitted in front, so that the doctor or operator will have his eyes and face protected from the rays when making examinations. Many kinds are made ; all or most are quite suitable

The most useful size for a fluorescent screen is about $9'' \times 7\frac{1}{2}''$.

THE PROPER MANAGEMENT OF THE APPARATUS INVOLVES ATTENTION TO A NUMBER OF DETAILS.

Firstly, it is important to see that the coil is properly connected to the battery or source of supply and that the interrupter works smoothly. The cables connected to the spark pillars for conveying the current to the tube must be kept sufficiently apart

to avoid sparking. It is not wise to allow either of the cables to touch the tube itself. A spark may pass at that point and puncture the glass. The tube itself should be firmly fitted in the holder and it is then necessary to ascertain whether the current is flowing in the right direction or not. If, when the switch is turned on, the tube shows an even hemisphere of fluorescence on the side facing the front of the anti-cathode, you may reasonably judge the current is passing in the right direction.

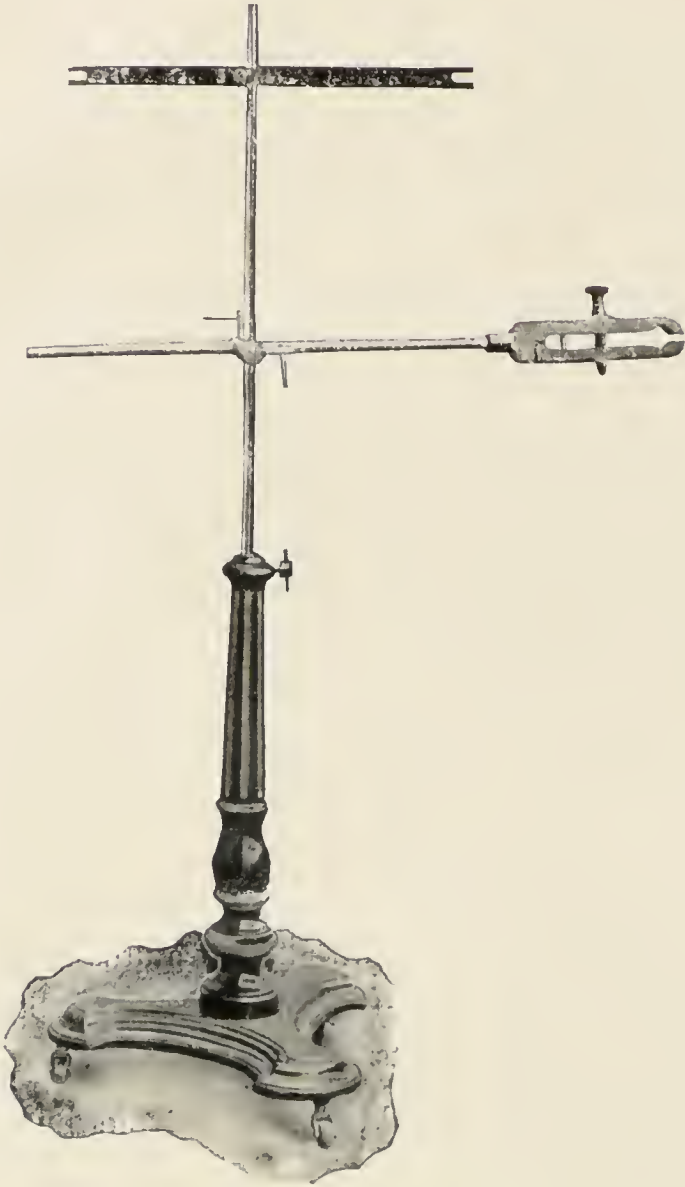
If, however, the fluorescence is patchy and irregular, the direction is probably wrong. This may be easily tested by placing the hand behind the fluorescent screen. If the current is correct, the bones will be easily seen; but if the current is flowing in the wrong direction, practically nothing will be seen through the fluorescent screen. At this stage the room may be darkened and the fluorescent screen brought into use. The hand should be held flat against the back of the screen and both should be approached to the front or fluorescent hemisphere of the tube. The bones can then be easily seen. By using different tubes the variations in the density of the shadows of the bones can be noted. It need scarcely be urged upon the beginner that he should practice extensively with his apparatus in order to learn the methods by which the best results are to be obtained before taking photographs of patients.

Precautions should always be taken to avoid burns, etc., from the X Rays.

Whenever possible, avoid standing in front of the luminous part of the tube.

Allow us to simply ask all those who are interested in this branch of medical science, to take warning from the sad results already well known of the reckless working of the X Rays.

FOCUS TUBE STAND & CABLE CARRIER.



No. 375. Fig. 25.

A handsome stand with heavy base and adjustable screws for main shaft and tube holder, cable carrier, etc.

NOTE.—As with focus tubes, there are a number of tube-holders. The one illustrated is a very simple type. For many purposes this type would be quite suitable; but if photography is the main feature, a more substantial apparatus is required. A diaphragm compressor is used and to give the necessary compression a heavy weight is fitted to the holder.

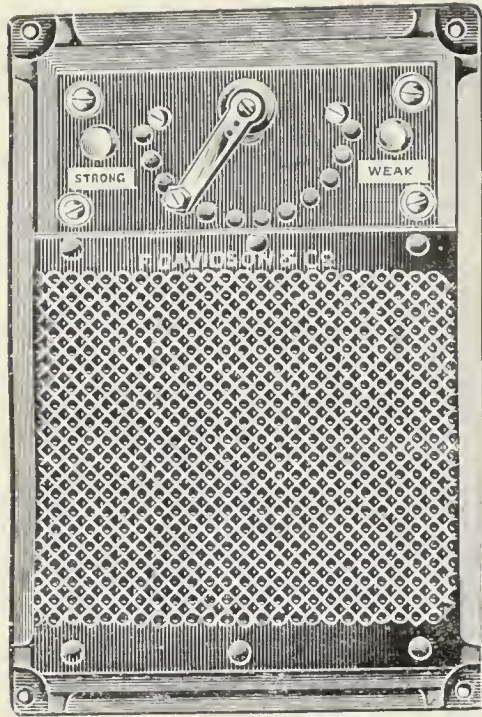


Fig. 26.

No 379

Rheostat for controlling the primary current for the spark coil.

CHAPTER XIII.

HOW TO TAKE X RAY PHOTOGRAPHS.

This forms an important item in medical work. Photographic plates are enclosed in light-tight envelopes of paper, first a yellow envelope which is then placed in a black one. The action of the ordinary light is thus prevented; but the passage of X Rays to the plate is not interfered with. Care is needed that the sensitive side of the plate should be known when in the envelopes. A good way is to place the plate in the yellow envelope with the sensitive side to the flap, then place this in the black envelope with the plain side to flap of same, the plate is then ready for use and you know that the side to expose to the rays is the smooth of the black envelope. The plate is then placed on a firm table and the limb or part to be photographed should be placed on it. The tube is then brought within about 18" of the part to be photographed, which by the way, must be kept quite still. Care must also be taken to avoid vibration of the tube. As soon as the exposure is concluded, switch off the current and

then the plate is taken and developed in the usual way. The length of exposure will vary according to the distance between the tube and object, also the magnitude of the current through the tube and the thickness and opacity of the object.

The distance of the tube from the plate is also important on account of its distortion. When special sharpness is wished for, it is best to have the tube at a greater distance away and to give a little longer exposure. In this way distortion is reduced to a minimum. When photographing bones in two different planes, the images of those nearest the tube may tend to obscure those nearest the plate. If the picture of the latter is wanted, the tube may be used closer to the plate. Although clothing is practically transparent to X Rays, yet it is desirable when taking photographs through thick parts of the body, such as the thigh or hip, trunk or pelvis, to remove superfluous clothes, as they offer some slight resistance to the rays, both by their material and their dye; but especially because buttons or hooks and eyes, or pins in the clothing will leave impressions on the plate.

CHAPTER XIV.

High Frequency Current.

This is a very rapidly alternating current, having a frequency of several thousands per second. Some time ago the method of treatment with this current was brought to England and boomed to such an extent that many felt that at last a method had been found to apply and cure all complaints. This was very unfortunate, as after a time it was not found to be able to cure with any certainty many cases of disease. The result was a set back and it has taken time to regain the important place in Electrical Treatment this useful method should occupy.

It has become popular and if used in the right way and applied in suitable cases, good results will undoubtedly be obtained.

We will here mention a few of the effects of this current upon

the human body. Firstly, and perhaps the most useful is the stimulating effect upon the skin and its tendency to relax the blood vessels, thus blood pressure is lowered and the surface temperature raised, causing a feeling of warmth and in some cases actual perspiration is observed.

In cases of Neuralgic pains good results have been obtained. Eczema has also been successfully treated. Lupus can also be treated with fair hope of success.

The Method of Application of the High Frequency may be by one of four ways.

1st, Auto Conduction.—The procedure in this application is to place the patient in a Solenoid made in the form of a cage of copper wire; this completely surrounds the patient, who is insulated from the cage itself. When the current is switched on, the copper wire on all sides discharges and the patient receives the discharge.

The patient need not undress, and, as some types of Solenoids are made to take a chair or couch, the treatment is not unpleasant. This method is called *Full Body Treatment*.

2nd, Auto Condensation.—This method is used a great deal in England, and it is perhaps the most comfortable one. For all the patient has to do, is to recline on a couch with a thick horse hair cushion. Underneath this, is a metal plate which is connected to one pole of the transformer. The second pole is fixed to a metal handle, which the patient holds. The current is switched on and the patient, being in the circuit, becomes charged. Vacuum electrodes are used instead of the handle, in many cases. Where it is required to effect a special area, this method is extremely useful.

3rd, The Effluve.—This method is often used and it differs from the others inasmuch as it is what is termed Mono-polar.

Only one pole of the High Frequency Current is used and this is connected to a metal brush or point, which gives off a quantity

of spark discharges, and when held fairly close to the patient, causes muscular contraction. This method is also used by means of a vacuum electrode instead of the metal brush or point and is very satisfactory.

4th, Direct Method.—This method, as the name implies, refers to the application when the electrodes are placed on the body. It is Mono-polar like the last and is often used for internal application. The electrode or Vacuum Tube is placed on the body before the current is switched on. With this and No. 3 it is wise to connect one pole of the transformer to earth, as better results are obtained by so doing.

The discharge from a vacuum is given in the same way as the brush discharge. There are many shapes and sizes of vacuum tubes for the different parts of the body. Good contact should be made, so that sparking is out of the question. For some internal applications, water cooled electrodes are used.

The high frequency current is used in cases of:—

General Nervous Debility.

Arterial Pressure.

Skin stimulation, etc., etc.

The appliances necessary for giving this method of treatment are:—

- | | |
|-----------------------|--------------------------------|
| 1. An Induction Coil. | 2. High Frequency Transformer. |
| 3. Couch. | 4. Heavily insulated Cable. |

These appliances are fully described on pages 59 and 60.

The most recent researches into the possibilities of this form of treatment are furnished by Dr. Doyen of Paris, who describes in *Treatment Local des Cancers Accessibles*, Paris, 29th March, 1910, how a large number of cases of accessible cancerous growths in various parts of the body have been successfully treated, thus adding greatly to our store of knowledge of the increasing value of the high frequency current. It places within our reach a method of treatment of certain malignant growths which must be of inestimable value.

HIGH FREQUENCY APPARATUS.

No. 102.

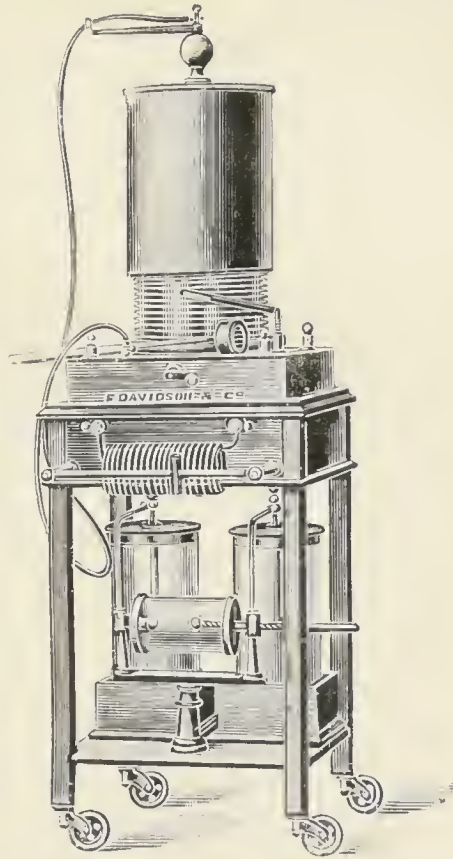


Fig. 27.

This consists of a D'Arsonval transformer with large Leyden jars, spark gap and resonator arranged on a table of polished mahogany with adjustable resistance and terminals for connecting the cables from the coils. Size of apparatus is 21" \times 21" \times 62".

No. 103.

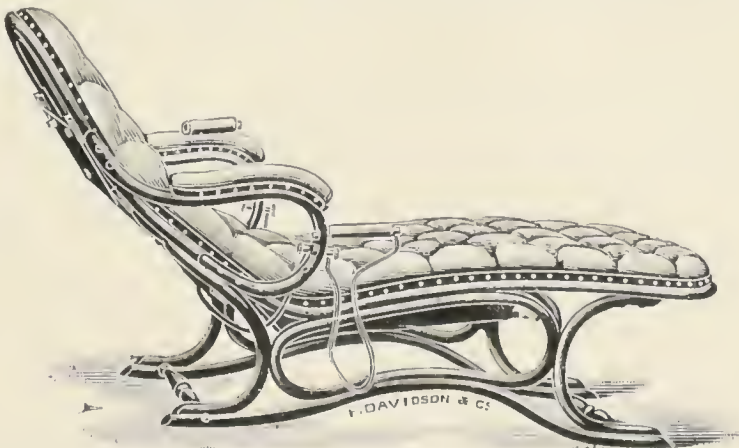


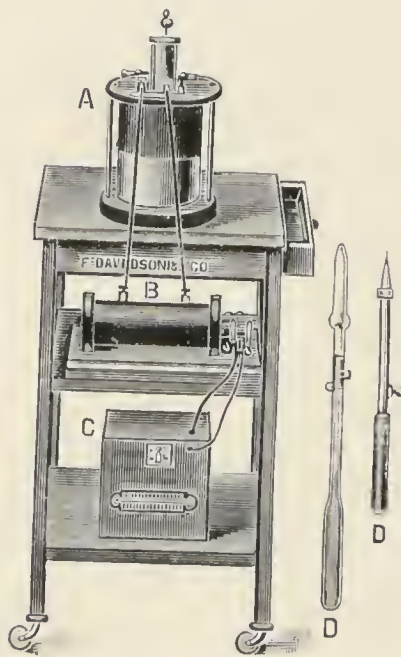
Fig. 28.

Condensator couch of Austrian bentwood, thick horse-hair mattress covered with dark leather, insulated zinc sheet and two large electrodes.

NEW HIGH FREQUENCY APPARATUS.

Comprising:

- A.—Transformer.
- B.—Induction Coil.
- C.—Accumulator.
- D.—Electrodes.



No. 102 A. Fig. 29

The whole mounted on handsome polished mahogany table mounted on castors, with draw for electrodes, cords, &c.

This apparatus will be found extremely useful for the administration of the effluve (or brush discharge). It also furnishes sufficient current for auto-condensation. If one takes into consideration the cost of types, many requiring as they do a large and costly coil, one can readily see the advantages offered in submitting this apparatus to the medical profession.

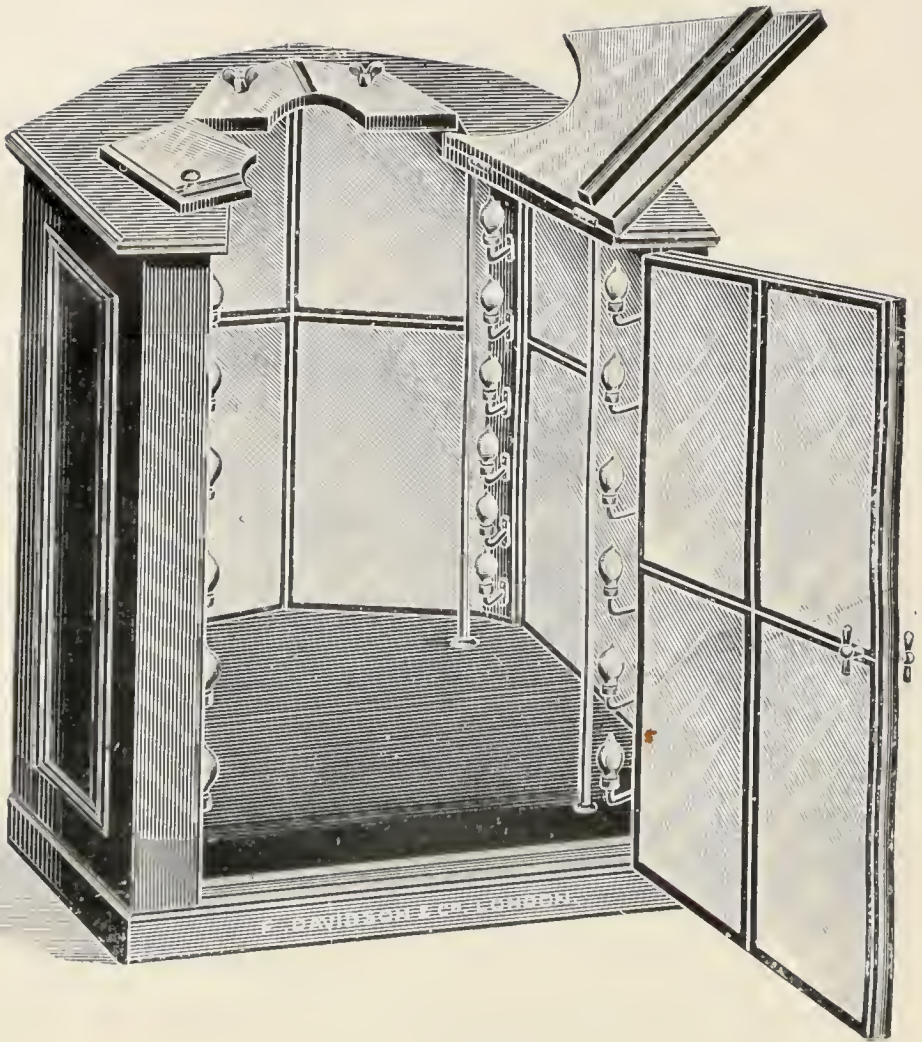
It is a most compact and cheap apparatus.

CHAPTER XV.

ELECTRIC LIGHT BATH CABINET.

By the introduction of this form of light application, much good has been done, for it is an accepted fact that light has a very great therapeutic value and with this type of bath the light and heat given off from a number of incandescent lamps, serves to make a very convenient form of Turkish Bath and Light Cure combined.

The temperature required to open the sweat glands is about 80° to 90° F. The arrangement of these baths makes it quite safe for the patients to apply the bath by themselves, for all they have to do, beyond sitting in the chair and closing the cabinet, is to switch on the current. This may be very easily done, for the switches are arranged within reach of the patient's arm, and as the head is not enclosed in the Cabinet, breathing is in no way affected. It will at once be seen that in this alone it has a very great advantage over the Turkish Bath, as people are often rendered quite faint by having to breathe the hot air and those who suffer with heart and lung troubles are not allowed to indulge in this form of refreshing and stimulating treatment; but by the introduction of the Electric Light Bath Cabinet all, or nearly so, may enjoy the stimulating effect of this form of Turkish Bath with safety.



No. 80. Fig. 30.

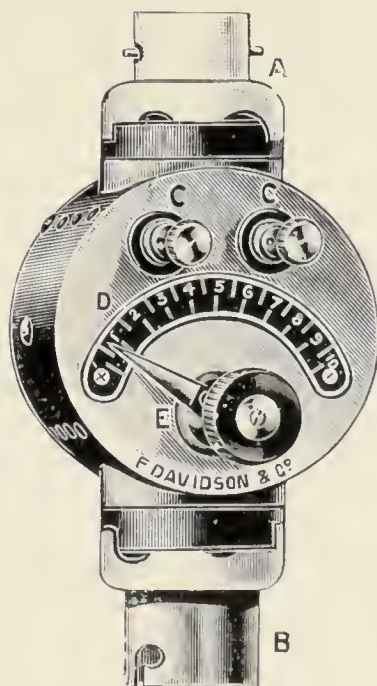
Splendidly finished, lined with opal glass and containing 24 lamps of 32 c.p. Switches and fuses are fixed to the outside, well within the reach of the patient when in the cabinet. He is thus enabled to reduce or increase the heat at will. The whole measures $4' \times 3' \times 4'$ in height. Chairs for use with this cabinet are made as a piano stool with back, admitting of the raising or lowering of the seat.

CHAPTER XVI.

PORTABLE RHEOSTAT FOR LIGHT.

For the illumination of small surgical lamps on the house current; either constant or alternating from 100 to 250 v. When used on the continuous current of low voltage, it will provide suitable current for galvanisation, electrolysis, etc., but a galvanometer should be included in the circuit. Its size is only $5'' \times 2\frac{1}{2}''$ and it can be carried in the pocket. It may be fitted to any existing lamp holder, and if used on a high voltage, say 200 v. house supply, a 50 c.p. lamp must be used to give sufficient current to illumine a 2, 4, 8 or 12 v. surgical lamp.

If the rheostat is used on a low voltage supply, a 32 c.p. lamp will be sufficient for a 2, 4, 8 or 12 v. surgical lamp.



No. 80 A. Fig. 31.

PORTABLE "SIMPLEX" ADAPTOR
(PATENT).

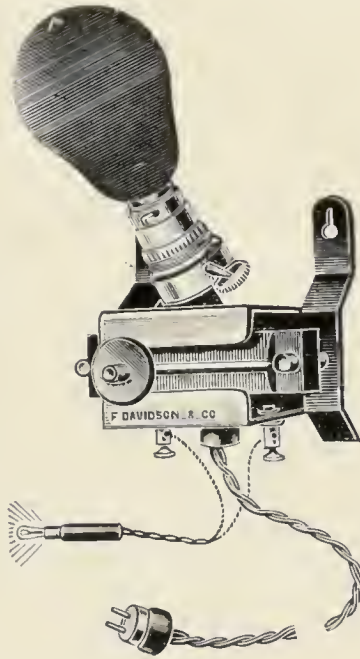


No. 80 B. Fig. 32.

For any voltage either continuous or alternating. A useful type for illuminating 4 to 12 v. surgical lamps. The resistance lamps are hidden from view.

WALL OR TABLE RHEOSTAT FOR LIGHT.

(Size without lamp 5" × 5" × 3")

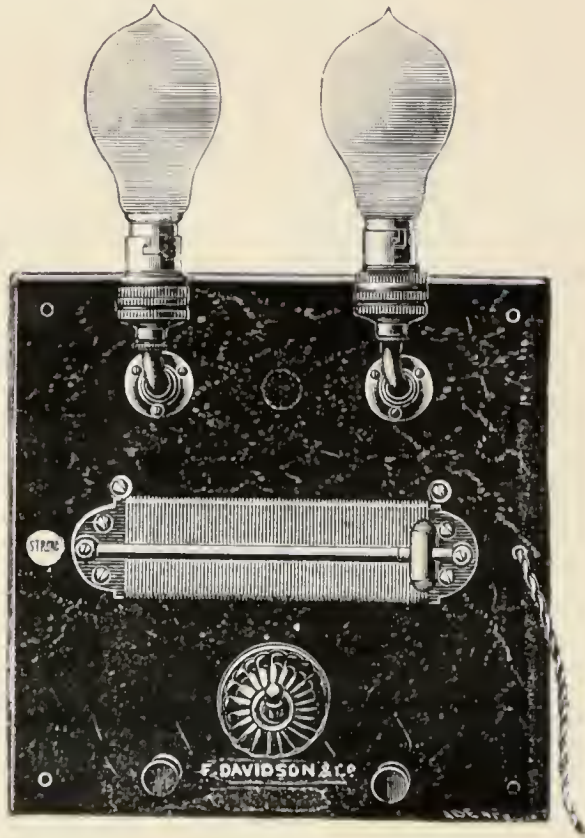


No. 80 D. Fig. 33.

A very handy type of adjustable rheostat for the illumination of small surgical lamps.

It is made to either hang on the wall or stand on a table. On the low voltage one may illumine 4 to 12 volt lamps by using a 32 c.p. lamp in resistance. For the high voltage supply a 50 c.p. lamp is required to illumine 12 volt lamps.

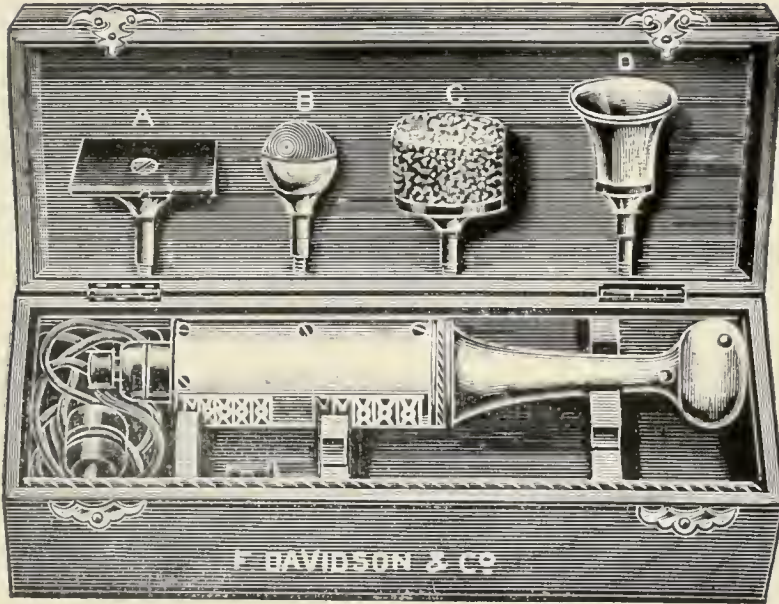
SWITCHBOARD RHEOSTAT.



No. 70. Fig. 34.

For the illumination of all sizes of surgical lamps on either continuous or alternating current, any voltage. The board is of polished slate and has two lamps fitted, together with an adjustable wire resistance. A switch for controlling entry of current and suitable terminals for transmission is provided. When the resistance slide is moved over to the end marked "Weak," practically no current passes. Its gradual progress to the other end, ensures an increasing illumination of the surgical lamps being used until the proper voltage is obtained. When the illumination is no longer required, push the slide back to the end marked "Weak" and switch off the main current.

CHAPTER XVII.

ELECTRIC VIBRATORY MASSAGE
by means of "THE VIBRO."

No. 430.

Fig. 35.

It can be attached to any existing lamp holder.



No 430.

Fig. 36.

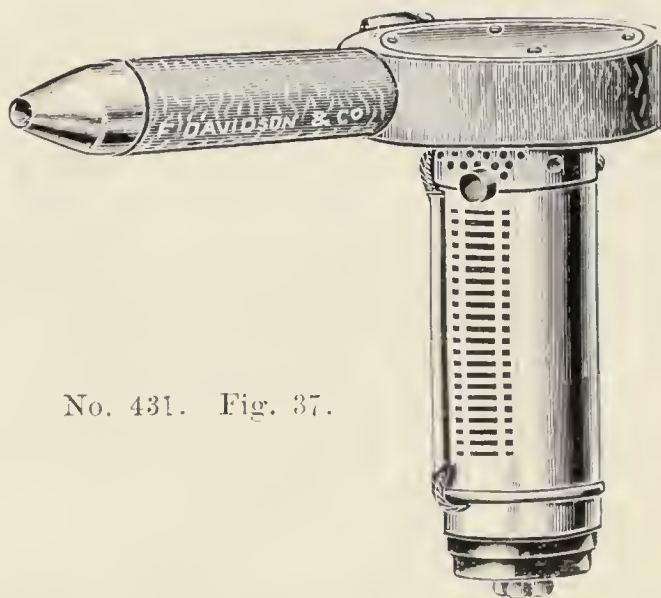
The value of vibratory massage is well known.

In the "VIBRO" we have a compact portable appliance by means of which this form of treatment can be applied without an expensive motor.

The motor is contained in the handle.

As this appliance can be used by the patient himself in many cases, the doctor can prescribe it where many personal visits are inconvenient.

THE "AIR DOUCHE."



No. 431. Fig. 37.

For the local treatment of Rheumatic troubles by means of dry hot air.

The "hot air" treatment for rheumatism can be strongly recommended.

The "AIR DOUCHE" provides within itself a simple but effective form of applying hot air to the part affected.

A motor is arranged inside the handle and any temperature between cold and hot can be obtained.

The "AIR DOUCHE" can be attached to any existing lamp holder.

CHAPTER XVIII.

CAUTERY.

Electricity provides us with simple and suitable means for performing minor operations of which cautery is the one most frequently employed.

Cautery operations may be carried out by means of:—

- 1—The house current.
- 2—Accumulators.
- 3—Dry Cells.

For the house current on the direct supply, a switchboard with a transformer or the Pantostat Figs. 16 and 17 is necessary.

It is well to note here why a transformer is required when one wishes to use the Direct or Continuous Current for cautery.

Firstly—To heat a cautery burner a current of from 18 to 30 ampères is required. If the main were used direct to the burner, the latter would be fused instantly.

Secondly—The main current has to be transformed into a lower voltage. This may be done in several ways.

The type of transformer most useful is a motor transformer by which the current reduction can be gradual.

For the House Current on the Alternating Circuit, PORTABLE appliances are made for cautery, and in addition, for the illumination of small surgical lamps and other purposes. It is only necessary to attach the plug to any lamp holder. See Nos. 78 and 79. Page 70.

NOTE.—*These can only be used on the alternating system.*

PORTABLE SWITCHBOARDS.

No. 79.

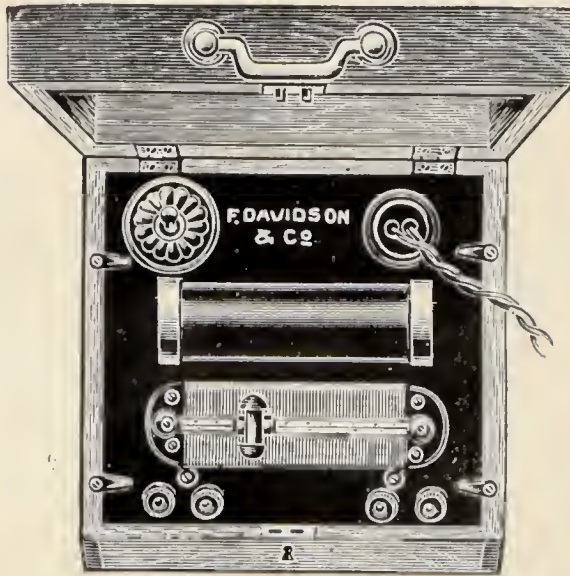


Fig. 38.

A portable switchboard for cautery only, on the alternating current. Board of polished slate, fitted with choking coil and adjustable resistance, switch and terminals, plug and flex with adaptor for fitting to house supply. The board is fitted in an oak case with handle.

No. 78.

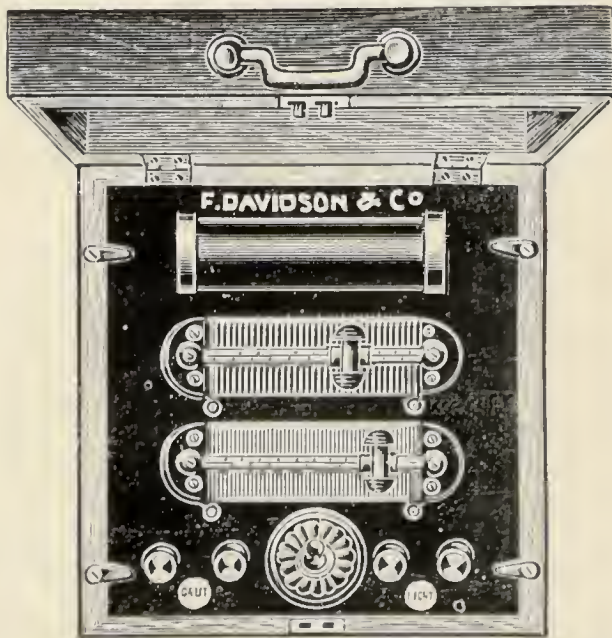


Fig. 39.

A portable switchboard for light and cautery on the alternating current, complete in oak case, size 12" \times 11" \times 4". The board is of polished slate fitted with choking coil and adjustable resistances for cautery and light, each marked, and with suitable terminals, also a switch with wire and plug all ready to attach to lamp holder of house supply.

A PORTABLE CAUTERY APPARATUS.

No. 18.

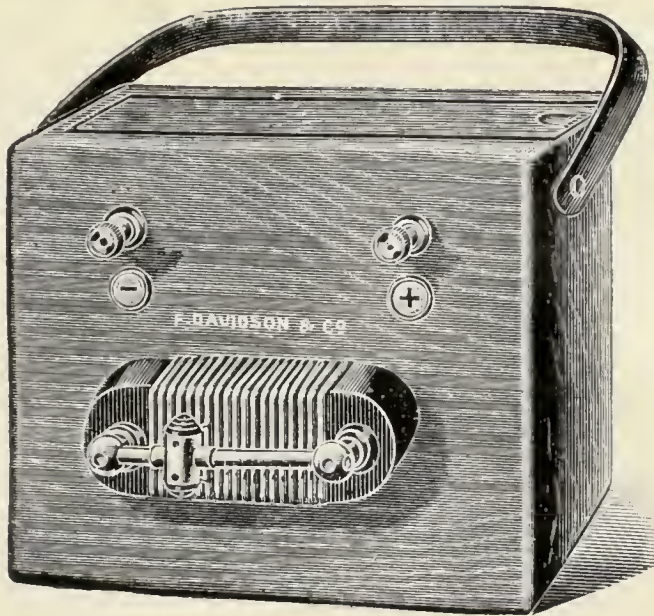


Fig. 40.

Comprising 1 "Davon" (registered) accumulator in handsome walnut wood box, with strap handle. Rheostat with slide movement. It weighs 11 lbs. A still better form is composed of 3 accumulators. (See below fig. 41)

PORTABLE APPARATUS FOR CAUTERY AND LIGHT.

No. 19 A.

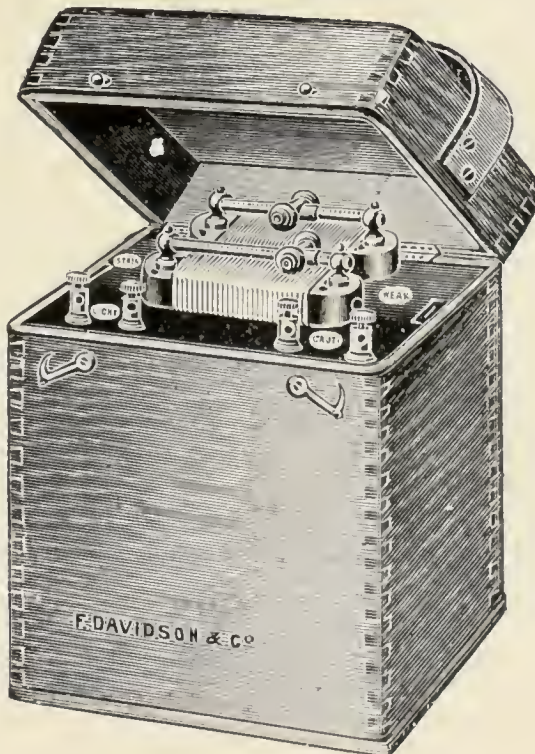
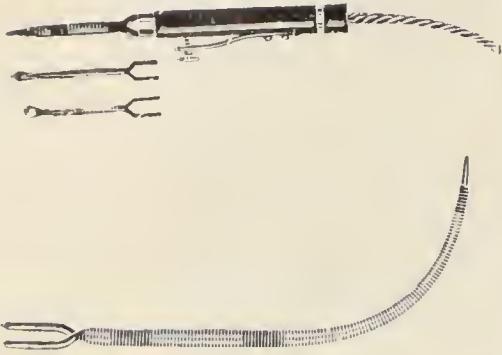


Fig. 41.

THE POCKET DRY CELL BATTERY.



No. 20.



Fig. 42.

Strongly recommended for Light Cautery work on the Throat, Ear, Nose and Eye.

It is NOT suitable for removal of nævi or any hard substance.

The box contains 1 special "Davon" (registered) dry battery, 1 holder and cord, 3 small burners, and 1 throat burner.

When the battery is exhausted for cautery purposes, it will still remain of service for the illumination of small surgical lamps for a long time.

It is advisable in all cases that the parts to be operated upon should be approached before the burner is heated.

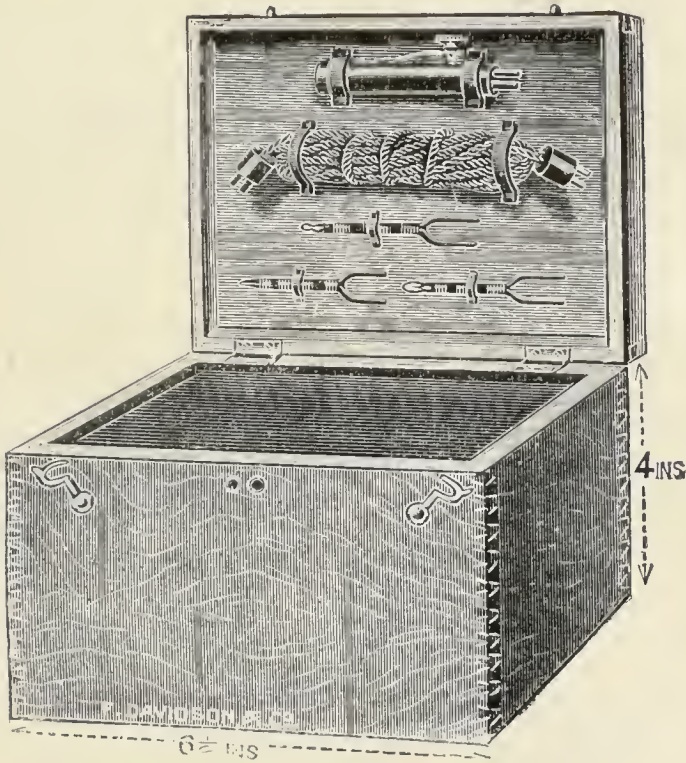
The handle is provided with a simple contact, only very slight pressure being necessary.

Special care should be taken to break the contact the moment the operation has been made. Used in this way, one may rely upon getting several small operations out of each battery.

The battery used for this cautery is the "Davon" (registered) dry battery referred to on page 14 and no other battery will answer with these burners.

The burners are made specially for the battery ; NO OTHERS WILL DO.

DRY CELL CAUTERY SET.



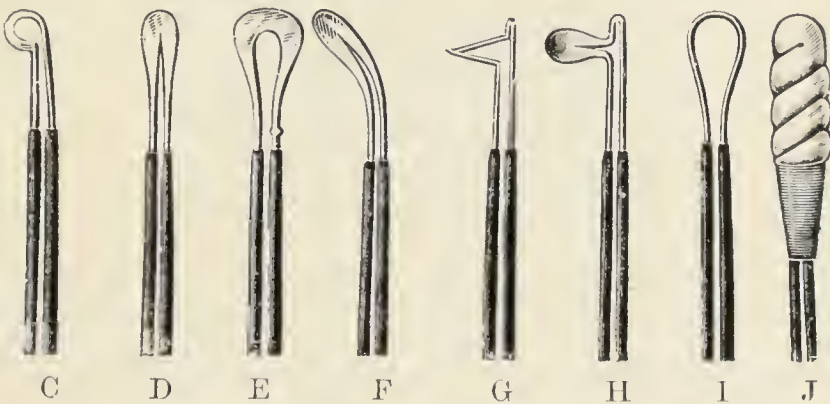
No. 21.

Fig. 13.

Containing 3 new "Davon" (registered) dry cells, cautery handle, cords and three burners.

Suitable for the same purposes as the pocket cautery ; but with 2 or 3 times the life, and with special burner this set may be used for the treatment of *recent* exterior *growths* ; *but not those of old standing*.

BURNERS AND KNIVES.



No 22.

Fig. 44.

UNIVERSAL HANDLE.

No. 23.

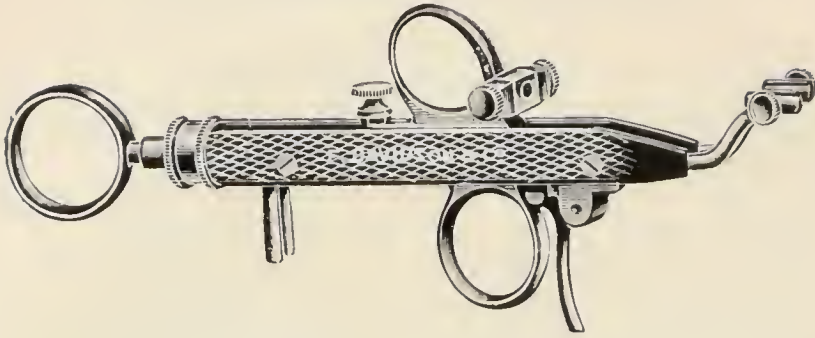
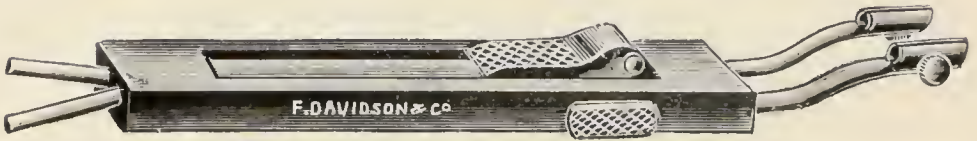


Fig. 45.

ORDINARY CAUTERY HANDLE.



-No. 24.

Fig. 46.

CAUTERY CORDS.

No 25.



Fig. 47.

ALUMINIUM RECTIFIER. *Patent No. 18013.*

No. 80 D.

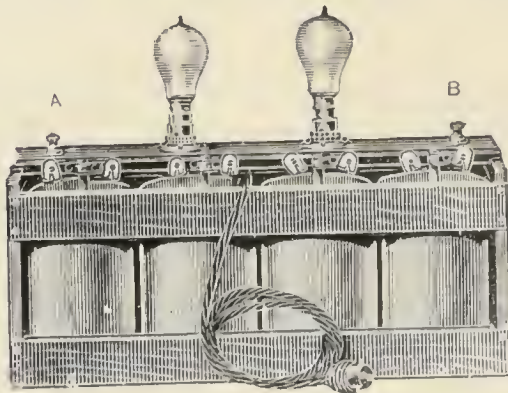


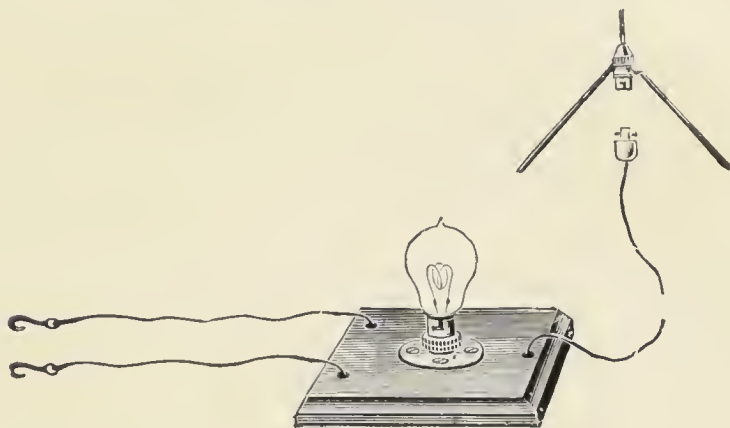
Fig. 48

For charging any class of accumulators, etc., direct from the alternating main. This apparatus works equally well on any periodicity or voltage. This is quite one of the simplest of transformers and makes no smell or noise and requires very little attention.

CHARGING ACCUMULATORS,

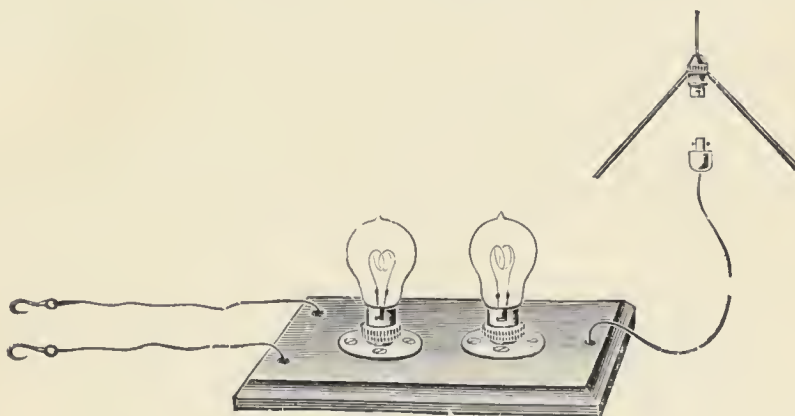
It is quite possible and indeed easy for medical men to charge their own accumulators providing their houses are lit by electricity from direct current. The only appliance necessary is a lamp resistance arranged as here illustrated.

CHARGING BOARDS.



MODEL A

No. 501. Fig. 49 B.



MODEL B

No. 50 B. Fig. 49 A.

In re-charging accumulators from the main, some form of resistance is required to cut the current down to a proper strength, and for this purpose an ordinary incandescent lamp is the most suitable when supported in the manner shown in illustrations. Models A and B are mounted on a polished walnut stand, fitted with plug to connect to source of supply and two cords to be attached to the accumulators to be charged.

Model "A" which is the simplest form of charging-board answers most purposes ; but where a number of accumulators are to be charged simultaneously, Model "B" will be found more convenient, as the right current is obtained more readily with the two lamps than with one.

TREATMENT OF THE ACCUMULATOR.

SEE PAGE 85.

- 1.—*Never exhaust the accumulator entirely* ; but have it re-charged as soon as it begins to grow weaker.
- 2.—Never let it *remain* uncharged, as the acid will destroy the plates.
- 3.—Do not allow it to remain unused for a long time.
- 4.—Much better results are obtained by re-charging about every three weeks, whether in use or not.

DIRECTIONS FOR CHARGING.

VOLTMETERS AND AMMETERS.—Dead beat instruments of this nature are invaluable to every one who uses accumulators whether for medical, surgical, or other purposes. The condition of the accumulator becomes apparent at once.

The difference between a "dead beat" instrument and one of the ordinary type is that the former registers *immediately* it is placed in position.

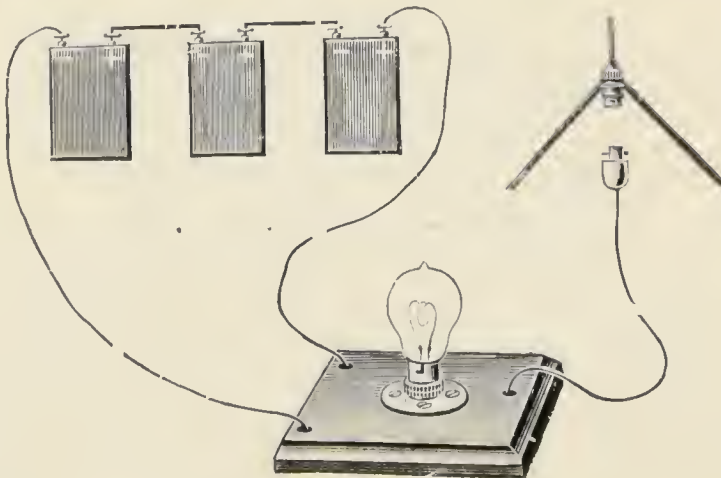


Fig. 49 B.

Shows the method of re-charging accumulators in series.

QUESTIONS AND ANSWERS.

CHAPTER XIX.

Questions and Answers.

Q.—What is the difference between the continuous current and the alternating current?

A.—The names “Continuous Current,” “Constant Current,” or “Galvanic Current” are given to the current which flows direct from positive to negative. So long as the circuit is closed and if the resistance in the circuit remains the same, the strength of current is uniform. An alternating current is one which rises from zero to a maximum and falls away again to be followed immediately by a reversed current, which also rises and falls in the same manner, thus its poles are ever changing.

Q.—What is a Transformer?

A.—A transformer consists of an iron core wound with two distinct windings of insulated wire; these are called the primary and secondary windings. When the alternating current is connected to the primary winding, a varying magnetic field will be set up, which will induce in the secondary a varying electromotive force, the value of which will depend upon the ratio and number of turns of wire in the coils.

Q.—Why is a transformer necessary to enable one to use an alternating house supply for Electrical Application?

A.—Because it has no definite poles.

Q.—Is a transformer required when the house supply is direct or continuous?

A.—No. Because the direct or continuous current, as the name implies, flows constantly from positive to negative.

Q.—What is a Resistance?

A.—A resistance (often called a wire rheostat) is generally made of German silver wire; the current enters one end and passes along the wire until it is taken off by an adjustable terminal joined to the other end of the resistance. This terminal is often made to slide along the wire, taking more into its circuit or reducing the length of resistance wire in the circuit. The more wire taken into the circuit, the smaller the output. There are of course many kinds of resistances made

Q.—What is Electromotive Force, "Potential"?

A.—Whatever tends to produce a transfer of electrification is called Electromotive Force.

Q.—What are Units? (Volts, Ohms and Ampères)

A.—To enable one to express in figures the amount of E. M. F. (Electromotive Force), the strength of current and the amount of resistance, etc. For example—the unit of the E.M.F. is called “volt.”

The unit of resistance is “Ohm.”

The unit of strength of current is called “ampère.”

Q.—What is Ohm’s Law?

A.—This law was enunciated by Dr. G. S. Ohm and is used for showing the relation between electromotive force, resistance and current. It is a very important law indeed, as by it, electrical measurements are made. The E.M.F. of one volt produces one ampère in a circuit, the resistance of which is one ohm. If the E.M.F. is increased to ten volts, we shall find the strength of the current is increased to ten ampères.

The strength increases with the E.M.F.; but if the resistance is increased, the current is diminished. Ten volts can only send one ampère through ten ohms, or half ampère through 20 ohms. The formula is $\frac{\text{E.M.F.}}{\text{R.}} = \text{C.}$ This resistance means all the different resistances in the circuit.

Ohm's Law therefore enables us to find out the strength of current if we know the E.M.F. and resistance but it also enables us to find out the resistance if we know the E.M.F. and strength of current.

In this case $\frac{E.M.F.}{C.} = R.$ and again we can find out the E.M.F. if we know the strength of current and also the resistance (strength of current \times resistance = E.M.F.)

Q.—What is the meaning of a “Watt.”

A.—“Watt” is the name given used to denote the product of volt and ampère.

Q.—What is an Ampère Hour?

A.—This term is used to determine the quantity of electricity which would be carried by one ampère in an hour. One ampère flowing for one second, carries one coulomb of electricity past any point in the circuit. There are 3,600 coulombs in one ampère hour.

Q.—What is a Meghom?

A.—A Meghom is one million ohms.

Q.—What is a Microvolt?

A.—A Microvolt is one-millionth of a volt?

Q.—What is a Milliampère ?

A.—A Milliampère is the one-thousandth part of an Ampère.

Q.—What is the Periodicity ?

A.—The periodicity or frequency of an alternating current means the number of periods or cycles occurring in one second.

Q.—What are Cycles or Periods ?

A.—When a closed coil or circuit of wire is rotated in a magnetic field, the wire is traversed by an alternating current of this kind, once for every complete revolution of the coil and this recurs again and again as often as the coil is rotated, giving one cycle or period for each revolution.

Q.—What is a Milliampèremeter or Galvanometer ?

A.—An instrument made to record the strength of a current passing through in fractions of ampères. In most electrical applications, a milliampèremeter should be in the circuit with the patient. One is then enabled to judge exactly how much current is passing through the patient. In many cases the dose is recorded in milliampères ; it will therefore be seen that a good meter is necessary.

Q.—What is Capacity ?

A.—The quantity of electricity that is required to raise the potential of any conductor from zero to full strength.

Q.—What is the difference between connecting cells in series and in parallel ?

A.—When batteries are said to be connected in series it means that the negative pole of one battery is connected to the positive pole of the next, the negative of this battery to the positive of the third battery and so on, the electromotive force of the combination measured from the positive pole of the first to the negative pole of the third (providing 3 batteries are in circuit) is thus increased, *e.g.*, if each battery has an electromotive force of four volts, the total will be 12 volts.

When batteries are said to be connected in parallel, it means that the positive (+) pole of each battery is connected to each other and their negative (—) poles connected to each negative (—). The electromotive force in this case is only equal to the electromotive force of one battery ; but its internal resistance is diminished in proportion to the number of batteries coupled together.

Illustration of the manner in which batteries are connected in series and in parallel.

	No. 1.	No. 2.	No. 3.
Series	— +	— +	— +

The — of No. 1 is connected to the + of No. 2, the — of No. 2 to + of No. 3, the — of No. 3, and the + of No. 1 are connected to the instrument or electrodes being used. See illustration page 76.

	No. 1.	No. 2.	No. 3.
Parallel	— +	— +	— +

The — of Nos. 1, 2 and 3 are all connected to each other. The + of Nos. 1, 2 and 3 are likewise connected to each other.

Q.—What are electrodes?

A.—The conductors through which the current is applied to the body are called electrodes.

Q.—What is the meaning of the word Cathode?

A.—The term Cathode or Kathode is given to the negative electrode.

Q.—What is the meaning of the word Anode?

A.—This term is given to the positive electrode.

Q.—What are Anode Anions?

A.—Those ions which are freed round the Anode.

Q.—How do you charge an accumulator?

A.—To charge an accumulator direct from the main you require a lamp resistance which must be connected to the accumulator; *e.g.*, take an ordinary lamp attached to a wire flex from the main; cut one of the cords in two and untwist it and uncover the wires at the two ends; then take a piece of litmas paper, moisten it and place the two wire ends on paper. The wire making a red stain is the positive and that making a blue the negative. Then attach the positive wire to the positive terminal of the accumulator and the negative to the negative terminal of the accumulator. It will be noticed then that the lamp will be illumined dimly, the reason being that the current is passing through the accumulator, thus losing some of its energy. If the wires were connected on the wrong terminals of the accumulator, the resistance lamp would burn brilliantly and the accumulator itself would be discharging instead of charging.

Q.—What is a Commutator?

A.—A Commutator, or in other words a current reverser, is an apparatus for reversing the direction of the current flow.

Q.—What is the meaning of Sinusoidal?

A.—The current from an alternating current dynamo is often called a sinusoidal current to signify that it approaches in its wave form a true sine curve.

Q.—Why is it necessary to have a rheostat in use with a motor?

A.—To regulate its speed and to prevent damage being done to the motor when starting it.

Q.—Why cannot a cautery burner be attached direct to the main?

A.—Because it would fuse instantly, the voltage being too high. It is necessary to transform the existing voltage into something lower by means of a rheostat and lamp. (See Figs. 13, 16, 17, 38, 39. Pages 35, 38 70)

Q.—What is necessary if current is direct?

A.—A Transformer.

Q.—What is necessary if the current is alternating?

A.—A Resistance.

Q.—What is the Solenoid of a High Frequency Apparatus?

A.—The Solenoid is a coil of wire connecting the outer coverings of the Leyden Jars.

Q.—What is the meaning of Effluve?

A.—Effluve is the name given the brush discharge of a High Frequency Current.

Q.—What is a *hard* tube?

A.—One in which the exhaustion has been carried to its limit.

Q.—What is a soft tube?

A.—One in which the exhaustion is not quite as complete as it might have been.

Q.—How can a hard tube be made softer?

A.—By heating; forcing a strong current through it by means of raising the current in the primary, care being taken to reduce it as soon as the desired effect has been obtained.

Q.—How can a soft tube be made hard?

A.—By switching on the current in the wrong direction for a short while; being careful not to overdo it, or the life of the tube will be materially shortened.

CHAPTER XX

*Points to be specially remembered in
dealing with*

DRY BATTERIES & ACCUMULATORS.

Do not condemn a battery or accumulator as being faulty without first ascertaining whether this is really the case. This is easily done by placing a voltmeter in circuit, when the voltage will be immediately made known. If the voltmeter shows the condition to be all right, it is then necessary to test connecting cords, handles, terminals, lamps, and the instruments themselves. Care should be taken to see that the lamps and terminals are screwed well home in their respective places. A loose screw will put a whole battery out of work.

Do not forget that dry batteries for lighting purpose which are generally composed of three cells of $1\frac{1}{2}$ volts each connected in series, are not intended for long constant use. They should be used intermittently and when at rest will then recover a great proportion of their efficiency. More is lost by using a dry battery of this nature for 30 minutes consecutively than by 20 operations of five minutes each.

Do not forget that two dry batteries used alternately for illuminating purposes will last three times as long as one. A dry battery cannot be re-charged.

Do not forget that to short circuit a dry battery or accumulator will often effectually spoil it.

Do not forget that where a number of accumulators or batteries are being used together and the end terminals do not show the full voltage or ampèreage, the probability is that one or more of the connections between them may be at fault, or one or more of the cells may be faulty. In such a case, each should be tested separately. If the batteries or accumulators are all in order, it is then certain that the connections between them are faulty. To ascertain which, if they are connected in parallel, each connection must be overhauled. See that the terminal screws are in contact with the *exposed* part of the connector and that no exposed part of the connector touches any other. If, however, they are connected in series, place the positive pole of the voltmeter on the positive terminal of the first accumulator or battery and the negative of the voltmeter on the negative of the second. The voltmeter should then give the sum of the voltage of the two accumulators.

If the connections between these two are wrong, the voltmeter will not register anything. In this

way the connections between any two batteries can be tested.

Do not forget that, in charging accumulators, if the poles are wrongly connected the accumulators will be destroyed. If in doubt use pole-testing paper. *See page 85.*

Do not forget that small accumulators require more frequent charging than large ones and even the latter should be charged every 2 or 3 weeks whether being used or not.

Do not forget that while 0.3 to 0.7 ampère only is required for lighting surgical lamps, from 5 to 30 ampères are required for cautery purposes.

Do not forget that all surgical lamps of low voltage are of a somewhat delicate nature and should not be over-run nor should they when finished with be put down violently or with a jerk, as then the filament is red hot and becomes consequently very brittle.

A carbon filament lamp has generally a longer life than one with metallic filament. The latter, however, gives a much better and whiter light with decidedly less consumption of current.

Ruby lamps for ophthalmoscopic work are said to cause less contraction of the pupil than white.

Do not forget that small surgical lamps can be connected to the house current, either alternating or direct, through a resistance (see Figs. 31, 32, 33 and 34) either for illuminating purposes only, or in conjunction with other apparatus for cautery, galvanisation, cataphoresis, electrolysis, faradisation, &c. See figs. 16 and 17.

Regarding the Electrical Testing of Muscles.

As an aid to diagnosis the electrical re-actions of the muscles is often of great assistance. In testing, it is wise to bear in mind that the normal re-actions may become changed as a result of injury or disease. As there may be changes in the behaviour of the muscles either to interrupted or continuous current, both forms of electrical excitation should be used in the examination of muscles. The usual method is to apply the active electrode to the muscle itself or near to its motor point. The indifferent electrode may be placed on any convenient part of the body. By moistening these electrodes more satisfactory results will be obtained.

Regarding Constant Current Applications.

In all applications of the constant current it is very important that the electrodes or electrode pads are placed firmly on to the parts to be treated, thus avoiding soreness of the skin. Another important point is that the poles should be carefully noted. Care must also be exercised to keep the electrodes quite clean. Electrodes of metals are better than those of carbon on this account; but it must be distinctly understood that before applying these electrodes to the skin they must be well covered by lint or other suitable material. If this is not done, sores are produced by the electrolytic action upon the surface of the skin. A good way is to cover each electrode with absorbent cotton wool and after the patient has been treated this may be thrown away and a fresh piece used for the next patient.

Where the application of the constant current is made to the head or regions round the heart, it is very necessary for the patient to be lying on a couch so that in case of sudden faintness the head may be immediately lowered. Direct applications to the heart region are not advocated, as their effect is quite as likely to be harmful as useful.

Regarding High Frequency Current.

Do not forget that the current is one of very high voltage and that its frequency varies thousands of times per second.

Do not forget that, when applying the current in the matter of Auto-Condensation and Auto-Conduction, it is necessary that the patient removes any metal or metallic substance from his or her clothing before the application, thus avoiding any chance of burn when the current is on.

Regarding Electrolysis for the removal of superfluous hair.

It is extremely important to remember that the needle is always connected to the negative pole of the battery. If by accident it should be used on the positive pole, a black mark will be made which unless treated at once will disfigure the patient. The positive electrode pad may either be held by the patient or placed on a suitable part of the body; but in either case it should be firmly secured. It is also wise to remember that if the follicle has been properly subjected to the current, no strength is required to remove it with the forceps.

PRECAUTIONS to be taken for the protection of the operator and patient *DURING X RAY OPERATIONS.*

Do not stand in front of the X Ray tube more than is absolutely necessary.

There is really no necessity to run any risk, as if the tube is enclosed in a box lined with rubber impregnated with oxide of lead, no damage can be done. Rubber impregnated with lead is impervious to the X Rays.

Do not perform X Ray operations with bare hands. Use X Ray proof gloves.

Do not often use the hands for testing the penetration of a tube, as they are very susceptible to injury.

Do not fail when using the X Rays for treatment, to protect those parts of a patient's body which *do not* require it.

Lead full rubber or glass tube shields are the best things to use for the purpose, as suitable funnels can be attached: these can be pressed against the patient, with the result that the part being treated is kept at a proper distance from the X Ray tube.

Do not fail to wear lead full spectacles.

The lenses should be large, well covering the eye and the immediately surrounding parts.

They can be made with plano, spherical convex or concave lenses, according to one's visual necessities.*

* Messrs. F. DAVIDSON & Co. make these spectacles on the premises.

CHAPTER XXI.

“THE LANCET,” Dec. 25th, 1909, says :

“Soon after the discovery of the Röntgen Rays, it was found that the rays had the power of causing temporary loss of hair, and when they were employed in ringworm, it was found that in certain cases the new hairs which grew after the throwing out of the old hairs were quite free from the disease. Investigation has shown that the X Rays have no bactericidal power, and therefore have no direct action on the fungus of ringworm; they merely cause a rapid and complete epilation of all the hairs, whether diseased or healthy, of the part exposed to their influence. The method of actually applying the treatment has now been placed on a firm basis. The essential principle is the accurate adjustment of the dose of the rays so that the desired effect, the removal of the hairs of the area treated, should be produced with unfailing certainty; but so that no excess of rays can be administered. In this way the dermatologist can be certain of not producing any permanent alopecia of the scalp and of not causing any X Ray burn. The results obtained have been most encouraging.”

The Electrolytic Administration of Drugs.

Pharmaceutical Journal, Sept. 19/08.

It depends upon the decomposition of a solution of salt by an electric current and applying one of the poles to the part of the body where the local action of a particular element is desired. In the case of sodium salicylate, for example, the sodium ions pass to the negative pole and the salicylic ions to the positive. Considerable impetus was given to this line of work by some striking experiments of Professor Leduc of the University of Nantes. Two rabbits were taken and an ear of one was strapped to an ear of the other by a pad of moist lint. To the outer ears were attached pads moistened with a solution of strychnine and joined to a battery of cells. On passing the current, the rabbit connected with the positive pole died immediately through receiving an electrolytic charge of strychnine, and on reversing the current the second rabbit died. The experiment was repeated with potassium cyanide, with the result that the rabbit connected with the negative pole died. Drugs administered in this form, act with rapidity in relatively small quantities and good results have been obtained by various investigators with quinine, lithium salts, salicylates, iodides, local anæsthetics, and other substances. Dr. Lewis Jones found that warts could be removed electrolytically by using magnesium sulphate, without causing pain or leaving a scar.

Corns, too, readily yield to sodium salicylate. It is interesting to note that ions may be removed from the body with equal ease. A patient had several black patches on the face produced many years before by an ointment containing arsenic. The patient's hand was placed in a vessel of water with the positive pole from a battery of six cells. A pad of wet lint was then placed over one of the black spots and connected for 15 minutes with the negative pole.

It was then noticed that the disfiguring patch had disappeared from the skin while the pad readily showed the presence of arsenic. Mr. Clague suggests that the positive wire in contact with the patient should be one that does not electrolyse under the conditions of the work ; platinum is always safe and aluminium is very useful ; but poles of iron, copper, or silver are to be avoided. A milliampère-meter in the circuit is a convenience, especially to a new worker. It is of great importance to use simple salts as far as possible. In illustration, if a weak alcoholic solution of strychnine hydrochloride be put into a dialyser standing in a vessel of water and a small current of from 10 to 15 milliampères be passed, strychnine will be detected in the outer vessel within a few minutes and on reversing the current it will as quickly be driven back ; but if a stronger current be used paraldehyde will be formed by decomposition of the alcohol. The intensity of the electric current required in cataphoresis is so low that patients rarely experience any difficulty in bearing the process.

We strongly recommend the perusal of the following articles published by the *Lancet*. They shew the results of some of the latest researches regarding certain branches of electrical treatment and go to prove its great value. The information given must be of the greatest service to medical men who are interested in the subject:

1.—“*The diagnosis and treatment of Sciatica,*”

BY

DR. WILFRED HARRIS.

October 31st, 1908.

2.—“*Medical Ionisation: its uses and possibilities,*”

BY

M. S. FINZI, M.B., London.

March 13th, 1909.

3.—“*The X Ray treatment of Ringworm of the scalp with special reference to the risks of Dermatitis and the suggested injury to the brain,*”

BY

J. M. H. MACLEOD, M.A. St. Andrews,
M.D. Aberdeen, M.R.C.P. London.

May 15th, 1909.

The British Medical Journal,

EPITOME OF CURRENT MEDICAL LITERATURE.

page 83,

NOVEMBER 27TH, 1909.

**Electrical Treatment may be given with success for
the following:—**

Arthritis.	Neurasthenia.
Ataxy Locomotor.	Obesity.
Atrophy : progressive [muscular.	Ocular affections.
Circulation disorders.	Optic neuritis.
Circumflex nerve injury.	Ovarian neuralgia.
Congestion.	Paralysis.
Constipation.	Piles.
Contracted joints.	Port wine mark.
Deltoid paralysis.	Prostatic enlargement.
Dysmenorrhœa.	Reaction of muscle.
Eczema.	Respiratory organs.
Epilepsy.	Rheumatism.
Facial paralysis.	Rheumatoid arthritis.
Gastric disorders.	Rickets.
Gout.	Ringworm.
Graves disease.	Sciatica.
Herpetic neuralgia.	Sexual disorders.
Hysteria.	Sprains.
Insomnia.	Strictures.
Leukaemia.	Urethral stricture.
Lupus.	Urinary organs.
Mammary glands.	Varicocele.
Menstrual troubles.	Women, diseases of.
Nævus.	Wry neck.
Neuralgia.	Etc., etc.

And all affections of the nervous system.

Sciatica Treated by Salicylic Ionization.

Some rather sensational cases of cure of sciatica by salicylic ionization are reported by Wullyamoz (*Arch. d'elec. med.*, October 10th, 1909). The patient takes a hot bath of half an hour's duration before the séance in order to rid the pores of any grease they may contain, the grease offering a strong resistance to the passage of the ions. The electrodes are large plates of lead, trapezoidal in shape, covered with absorbent materials after the manner suggested by Leduc. The cathode is charged with a solution of salicylate of Soda to 3 per cent., as hot as possible—about 50° C.—the speed and number of the ions being proportional to the temperature. The patient lies upon the cathode, and the anode is applied to the abdomen, thigh and leg. The duration of the séances is from sixty to ninety minutes, and at the beginning of treatment they take place every two or three days. The intensity of the current generally reaches 200 milliamperes. If the patient feels a burn, a layer of caoutchouc is placed between the skin and the electrode at that point. The number of séances varies between one and fifteen. Eighteen observances are reported, with remarkable results in every case save one. The exception was an alcoholic, in whom the treatment was checked owing to his intemperate habits. Some cures were obtained after the patients had taken long but ineffectual courses of thermal baths. One patient, aged 73, had suffered more or less from sciatic pain of the left thigh for six years, and after seven séances he could climb hills like a young man and had no return of the pain. A plumber who had suffered from sciatica for two months, and had to keep his room for fifteen days, was able to return to his employment after four séances. Another man, who had suffered from sciatic pain since eleven o'clock in the morning, and was carried to the doctor's in the late afternoon, had ninety minutes' séance, after which he felt so well that on the same evening he assisted at a ball!

*CHAPTER XXII.***TREATMENT.****Anchylosis.**

A one or two per. cent. solution of Sodium Chloride is required. Take a thick pad of absorbent cotton wool saturated with a warm solution of Sodium Chloride, apply this to the leg, and place over it a sheet of tin connected to the positive pole of the battery or source of supply. The negative pole is attached to a second compress of wool saturated with a warm solution of salt and water. Place this on the affected part and over same press a second tin sheet, keep both electrodes fairly tightly pressed and pass a current of from 50 to 100 m/a. There is a little pain; but it gradually passes off. Allow the current to pass for 35 to 40 minutes. Burns are avoided if good contact is made. Speaking generally this treatment is not painful after the first few minutes. The sittings should take place three or four times a week.

Ataxy Locomotor.

The constant current may be applied. The electrodes being placed on the dorsal and lumbar regions.

Boils and Carbuncles.

Take an epilation needle attached to the negative pole of the source of supply and insert into the orifice. The positive electrode may be held by the patient. A current of about 7 m/a should be allowed to pass for four minutes. Good effects are obtained by moving the needle gently. Discharge takes place. The needle may then be removed and a fresh one connected to the positive pole, instead of the negative, inserted in the orifice, the patient holding the negative electrode. This serves to disinfect the follicle. One application is often enough.

Chilblains.

A patient suffering from chilblains will be well advised, if, during the autumn months, he takes one or two Induction Coil Baths. This will practically safeguard him from chilblains during the winter. The necessary procedure is quite simple. If the hand is the part to be treated, all one has to do is to attach one wire from the coil to an electrode and fit on the arm, and the other to an electrode in a china basin containing a weak solution of salt water. Place the affected hand in the water and switch on the current. It may be taken fairly strong. In the same manner feet may be treated.

Auditory Nerve Deafness.

After careful testing, fix aural electrode over the head, so that the electrode pads of 1" diameter press on the external auditory meatus. Place wool pads saturated with a solution of salt and water between these pads and the ear; see that contact is good. Attach this electrode to the "—" negative pole of battery or suitable supply. Place a fairly large saturated metallic covered pad on the back of patient's neck slightly to one side, attach this electrode to the "+" positive pole of the battery. This pad must be kept tightly in position to avoid bad contact. Gradually increase the current to five or six milliamperes. The patient must be watched for signs of faintness; if these occur cut off the current at once. In the ordinary way each sitting should last from 15 to 20 minutes, with the current gradually increased and decreased between one and five milliamperes. Many very satisfactory results are obtained.

The same application suits **Tinnitus Aurium**.

Gleet.

An ebonite tube with a number of perforations forms a handy and serviceable electrode. At one end may be screwed olives of

various sizes. At the top or terminal end a tap is fitted inside. Through this tube is passed a platinum wire with terminal at its end for attaching the wire from source of supply. After inserting the instrument, press the meatus round same and by means of a syringe, introduce about ten grammes of one and a half per. cent. solution of silver nitrate. This escapes into the urethra and balloons it. Close the tap and connect the terminal end of the platinum wire to the positive (+) wire of source of supply. The negative pole pad may be placed in any convenient part of the body. The current must only be a weak one at first; but may be strengthened up to about 30 m/a. This dose should continue for about 15 minutes.

The silver nitrate becomes decomposed and the ions penetrate the surrounding tissues.

In the same manner zinc sulphate may be administered, giving a current of about 3 m/a for the same period as with the silver nitrate. There is very little pain felt and in a number of cases the method has proved very successful.

Hæmorrhoids.

A platinum needle connected to the negative pole of source of supply may be inserted into the Hæmorrhoidal mass. The positive electrode may be placed on a convenient part of the body. A current of 10 m/a may be given and in many cases the Hæmorrhoid fades away. Another good method is to introduce a hollow rectal electrode, having filled same with cotton wool saturated with a weak solution of copper sulphate.

Hair Removal.

Although a somewhat trying operation, if carefully carried out, the following will be found an excellent method.

Allow the patient to recline on a couch facing a good light. The positive electrode pad (an inverted wrist pad makes a conve-

nient electrode for the patient to hold in her hand) must be saturated with a salt and water solution. The negative wire is attached to the needle which must be inserted as near as possible to the follicle, the depth being about $\frac{1}{8}$ of an inch. Allow a weak current to pass for a few seconds, when froth will be noticed round the hair and needle. When the latter is removed take hold of the hair gently with forceps and if the electrolysis has done its work, the hair may be removed without any force. If the hair is firm, it is wise to leave it and to select another, returning to this one later during the séance.

Care should be taken that the needle is never connected to the positive pole. If this happens and the needle is inserted, an indelible black mark will be the result.

Infantile Paralysis.

After a test of the muscles, the affected limb should be measured and the amount above normal carefully noted, as also the faulty altitude of the limb.

The colour and temperature should be observed, also signs of recent chilblains. The induction coil current, taken through a bath, often forms a sufficient cure. The application of the constant current is also very successful.

Nævi.

Providing the size is not great, Electrolysis may be employed with care. If no scar worth speaking of is to be left, the operation must be carefully performed. Connect either one or two needles to the negative pole and the same number to the positive pole and insert horizontally, using a current of between 20 and 30 m.a. Care should be taken that the needles do not touch horizontally. The needles in the positive wire will after a while stick, and care must be taken in withdrawing these. Switch off the current before withdrawing any of the needles, when slotting has commenced.

Rheumatism.

On account of the variety of so called rheumatic disorders, it is difficult to give any certain direction for Electrical Treatment. Much good has been done in the case of stiff joints by the application of the Constant Current with saturated pads of salt and water, also Sodium Chloride. Heat has also proved useful. In the case of Muscular Rheumatism, General Electrolization has been proved beneficial.

Rheumatoid Arthritis.

General electrolization is in this case very useful applied by means of the cell baths, making use of the Sinusoidal Current. Ionic Medication is at present being tried with a very fair amount of success. Again, the local application of hot air and hot pads also forms a means of diminishing the pain.

For details of procedure in cases where Ionic Medication is tried, one could not do better than read the recent reports in both "British Medical Journal" and "Lancet".

Rodent Ulcer.

The treatment of this disease as advocated by Dr. Lewis Jones has proved extremely useful.

The method of application is as follows :—

A large pad of wool saturated in a solution of Sulphate of Zinc, ten grains to the ounce, is placed on the spot to be treated. On this pad a zinc electrode is pressed and connected to the positive pole of the source of supply. The negative electrode may be placed on any convenient part of the body or held by the patient. A current of about 10 m/a for ten to fifteen minutes is applied. If the case is successfully treated, the ulcer turns a whitish colour and fades away.

Urinary Organs.

Much good can be done in cases such as incontinence of the urine. This is often met with in general practice and which, if left unattended, makes the life of a patient, to say the least of it, uncomfortable. The trouble is often due to want of tone in the sphincter of the bladder and even slight exercise causes expulsion of urine. This is often the case when heavy weights are lifted or when sneezing or coughing.

The female urethra can be strengthened by introducing a bare metal electrode of suitable shape. The second indifferent electrode may be placed upon the lower dorsal region of the back. Care should be taken that the metal electrode does not go in too far. The current is painful; but to do much good this must be borne, as a small current would not be able to affect the nerve centres. The induction current is used for a few minutes, then the constant of about 7 m/a. By constant reversals of flow, damage to the skin and mucous membrane is avoided.

Warts.

Ionisation proves a most successful method for the treatment of warts. The positive electrode having a pad of wool saturated in a solution of Magnesium Sulphate (20 grains to the ounce) should be applied to the wart or warting surface. The negative electrode having a pad saturated in a salt and water solution may be placed on any convenient part of the patient's body. A current of six or seven milliamperes should be given for ten or twelve minutes.

Diseases of Women.

It is perhaps in these cases that electrical treatment has been found of the greatest value, *e.g.*, in Gynæcological practice. Much very excellent work has been done and a quantity of literature has been written since Dr. Apostale introduced his methods for treating the Uterine Mucous Membrane by electrolysis.

It is not for us to go into this subject, even if space would permit. We shall therefore only take one or two cases and offer suggested methods of treatment. At the same time we are fully aware that in most of these cases, more than one method of treatment has been advocated and almost all seem to have some excellent points.

Amenorrhœa.

Good results have been obtained by using the induction coil current, applying this direct to the Uterus and when certain conditions are present, the Electric Bath may be used with advantage.

Mammary Glands.

For promoting the secretion of milk, electrical stimulation has been found useful. As a means of increasing the size of the breasts in cases of defective development, it has also proved helpful.

Dysmenorrhœa.

The positive charge of the statical breeze with the negative breeze applied to the spine and loins, has resulted in good results being obtained.

It is not unpleasant and should be tried daily for a week before the date of the menstrual flow.

In Parturition.

It is perhaps in these cases that almost all medical men agree as to the value of a small Induction Coil. In these cases the current is used for strengthening the uterine contractions. It will at once be understood that after the birth of a child, a firm uterine contraction is necessary, if only to diminish the possibilities of a Post-partum hæmorrhage. In cases of miscarriage it has also proved of value to diminish flooding.

CHAPTER XXIII.

**ELECTRICAL AIDS TO DIAGNOSIS AND
SURGERY.**

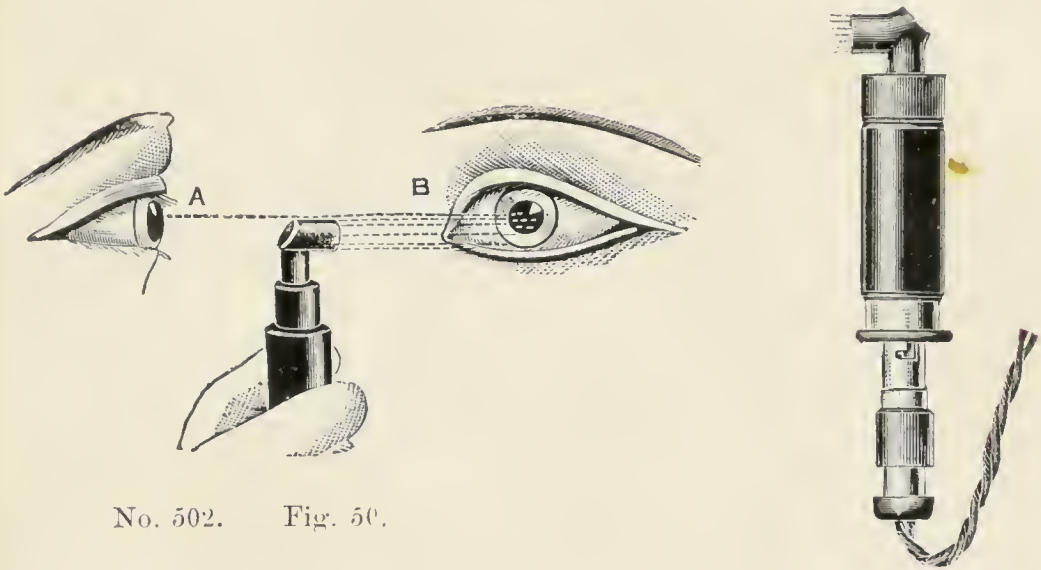
The general application of electricity as an illuminant for various surgical appliances is but one of its many uses. Appliances are now made for the examination, through all cavities of the body, by means of which diagnosis and treatment are simplified. Examination by means of trans-illumination can now be readily carried out and cauterization or other treatment of deep seated affected parts, is rendered comparatively easy.

It will not be out of place, therefore, in a work of this kind to illustrate and describe the most useful appliances now in use for the above purposes.

For MANY years we depended upon *other nations* for electrical appliances. Messrs. F. DAVIDSON & Co. are the *actual* makers of *most* of the things they sell.

EXAMINATION OF THE EYE.

Under ordinary conditions *the management of one's light* has always been the source of difficulty to the non-expert in making ophthalmoscopic examinations.



THE NEW DIRECT OPHTHALMIC ILLUMINATOR.

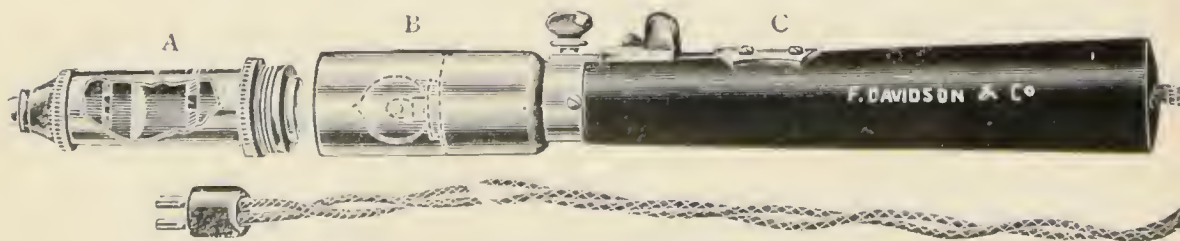
The illustrations show how this very practical instrument is used. The observer "A" holds it about two inches from the patient so that the upper rim of the projecting tube is *just below* the centre of the patient's pupil "B," and slightly INCLINED DOWNWARD. He then looks OVER IT and *direct* as from A to B, when, if the room be darkened and the pupil dilated, it is almost as easy to see the details of the fundus as LOOKING THROUGH A KEYHOLE INTO A LIGHTED ROOM.

Extract from "British Medical Journal," July 30th, 1904.

ADVANTAGES :—

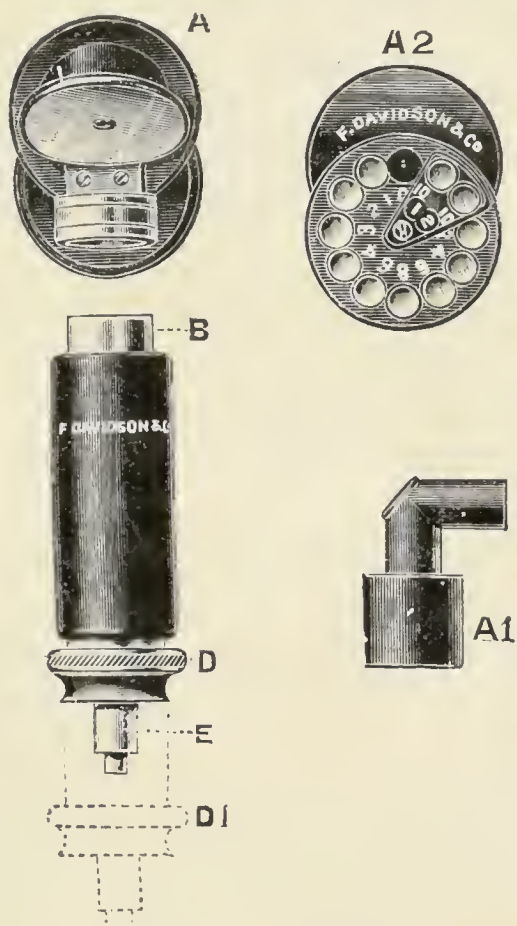
- 1—*The most complete illumination of the largest possible field.*
- 2—Great clearness and strength of light on the picture, with comparatively small intensiveness of light.
- 3—No disturbing contraction of the pupil in looking for the yellow spot.
- 4—No trouble through reflex of the cornea.
- 5—No loss of time in getting the light reflected.
- 6—AN EASY & QUICK EXAMINATION IS POSSIBLE WITHOUT SPECIAL STUDY.
- 7—A general practitioner, even if he is not expert in eye-work is able to examine the fundus of a patient confined to sick bed.
- 8—ITS VERY LOW COST.
- 9—Absolutely the best means of teaching the examination of the retina by the direct method.
- 10—It can be used with dry battery, accumulator or house current, through a suitable rheostat (see Figs. 31 to 34).

ILLUMINATOR FOR TESTING PUPILLARY RE-ACTION.



No. 503. Fig. 51.

A NEW ELECTRIC OPHTHALMOSCOPE, DAVIDSON'S PATENT.



No 501,

Fig. 52.

This appliance combines in one instrument the *Electric Retinoscope* and the *Direct Ophthalmic Illuminator*. It is unique inasmuch as the retinoscopic effect of the *plane* and the *concave* mirror can be obtained at will.

For retinoscopy the cap A. is put on.

For retinoscopy with a *plane* mirror the position of the lamp is close under the lens which is inside the cylinder C, as in illustration.

For retinoscopy with a *concave* mirror the lamp should be drawn to its extremity as shown by dotted lines in illustration.

To alter the position of the lamp grasp the part D. with the thumb and forefinger, giving it a half turn to the left. This will bring the lamp into the required position for retinoscopy with a concave mirror.

A half turn to the right will again bring the lamp into position for retinoscopy with the *plane* mirror, and *also for Direct Illumination*.

DAVIDSON'S PATENT OPHTHALMOSCOPE may also be used for indirect examination with an object lens, using the retinoscopy top A. The position of the lamp for this purpose is half way.

The lamp supplied is one with metallic filament thus ensuring brilliant illumination.

With this ophthalmoscope it is not necessary to get close to the patient in direct examination : an obvious advantage.

ELECTRIC RETINOSCOPE.

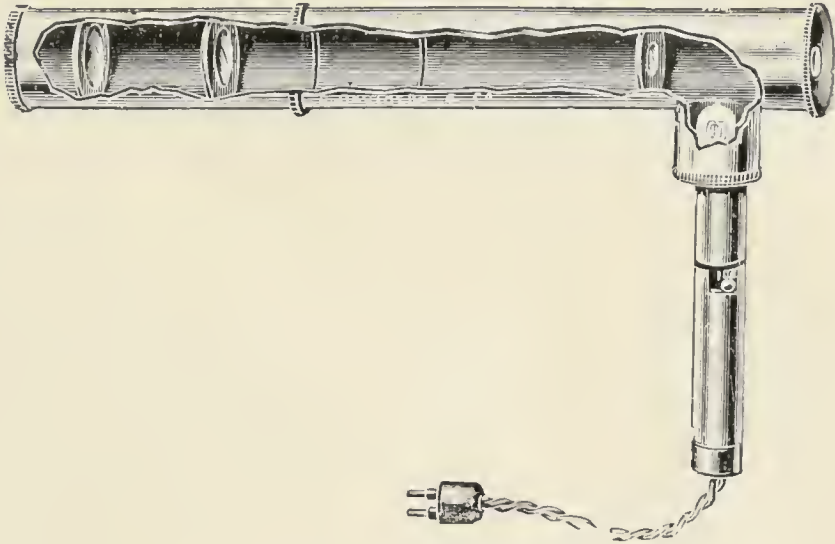
The mirror is concave ; but for those who prefer a plane mirror, the latter can be supplied. The instrument can also be used for *Indirect Examination*. The light, being under the operator's control, can be projected on to the pupil of the patient's eye, when the reflex becomes visible immediately and *can be kept in view* during the whole period of examination.



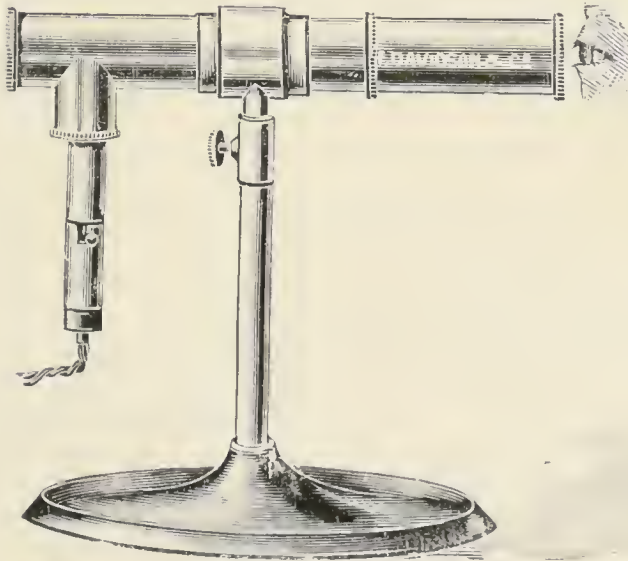
No. 505. Fig 53.

NEW LUMINOUS MICROSCOPE FOR THE CORNEA.

BRILLIANT ILLUMINATION AND DEFINITION.



No. 506. Fig. 54.

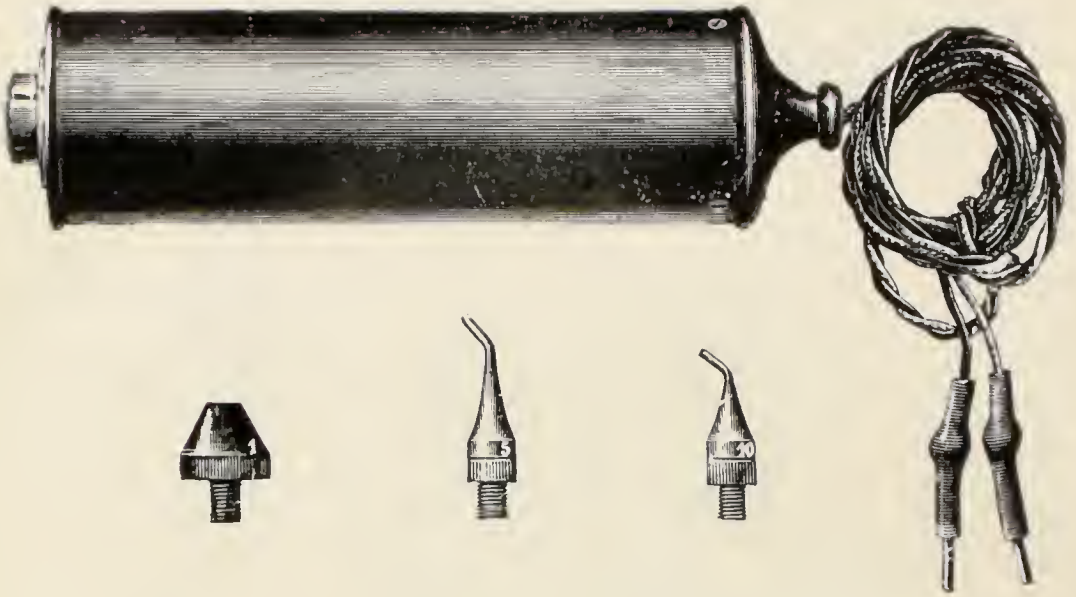


No. 507. Fig. 55

This microscope gives a magnification of 35 diameters with the field of 6 diameters. It gives an inverted image.

No. 506 can be easily carried in the waistcoat pocket.

EYE MAGNETS FOR REMOVING METALLIC SUBSTANCES FROM THE EYES.

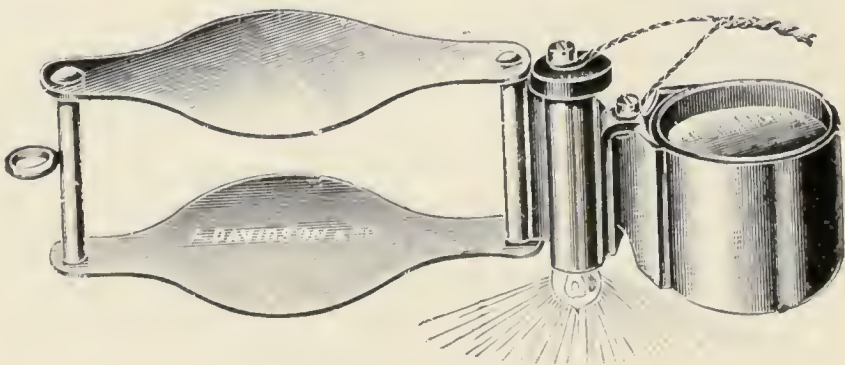


No. 508. Fig. 56.

The 110 volt magnet can be placed in *direct* connection with the house current of this voltage *without any resistance* of any kind; the 220 volt magnet of course on a 220 volt current.

They may not be used on alternating current.

THE ACHRO-ELECTRIC LENS.



No. 509. Fig. 57.

Achromatic corneal magnifier, consisting of a powerful achromatic lens with electric bulb attachment.

APPARATUS FOR TRANS-ILLUMINATION
AND EXAMINATION OF THE EAR,
NOSE AND THROAT.



Fig. 1.

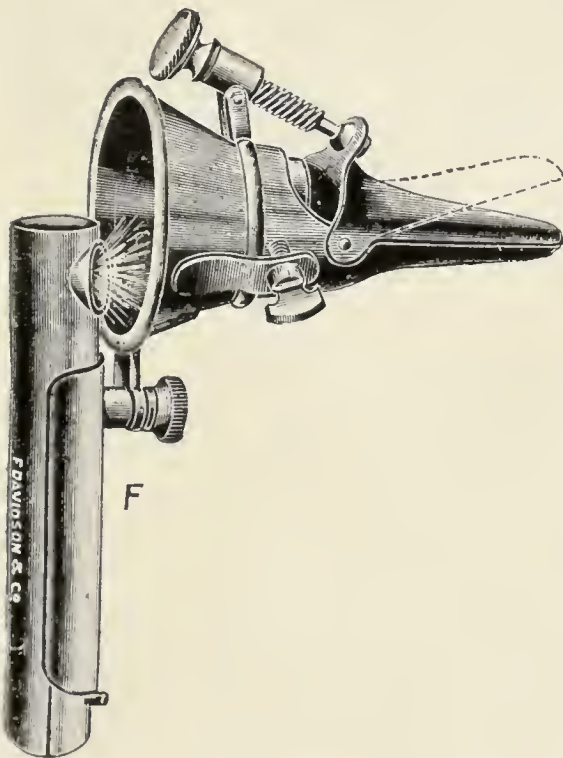


Fig. 2.

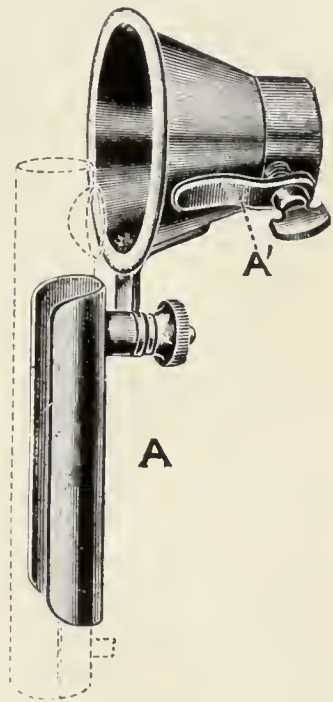


Fig. 3

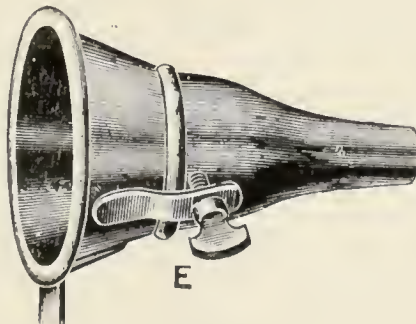


Fig. 4.
No. 510.

Fig. 4.



FULL SIZE

Fig. 5 A.

Twin lamp fitting for illuminating the antrum.



Double frontal sinus fitting. To be put over the twin lamp fitting for the trans-illumination of the frontal sinuses.



FULL SIZE

5 B.

Single sinus fitting.

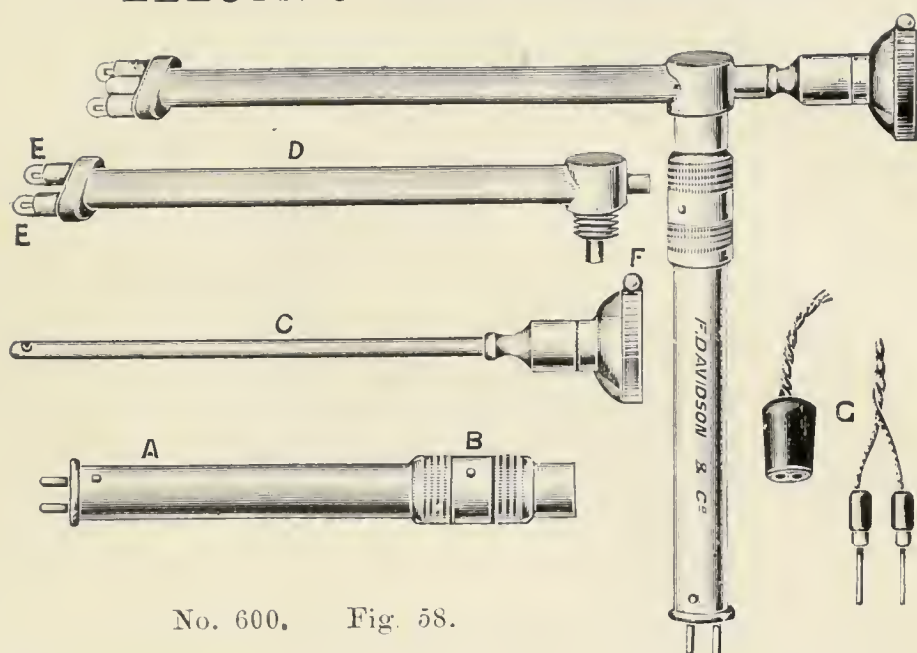
No. 510.

Fig. 1. shows the main lighting tube with lamp and mirror attached for laryngoscopy. *Fig. 2* is a funnel fitting with powerful lens to be put over lighting tube after the mirror has been removed. *Figs. 3* and *4* show nasal and aural specula in position. *Fig. 5 A.* Twin lamp fitting.

It is impossible to get a more brilliant illumination of the ear, nose and throat than the combined appliance gives. Light can be placed to right or left of specula, one hand holds it and the other remains for use of a probe, &c. For illumination of the antrum the twin lamp fitting is inserted in the lighting tube.

For illuminating the frontal sinuses, the double frontal sinus fitting is placed over the twin lamp fitting. For trans-illumination of the sclera the single sinus fitting 5 B. is placed over the single lamp in *Fig. 1.*

ELECTRIC PHARYNGOSCOPE.



No. 600. Fig. 58.

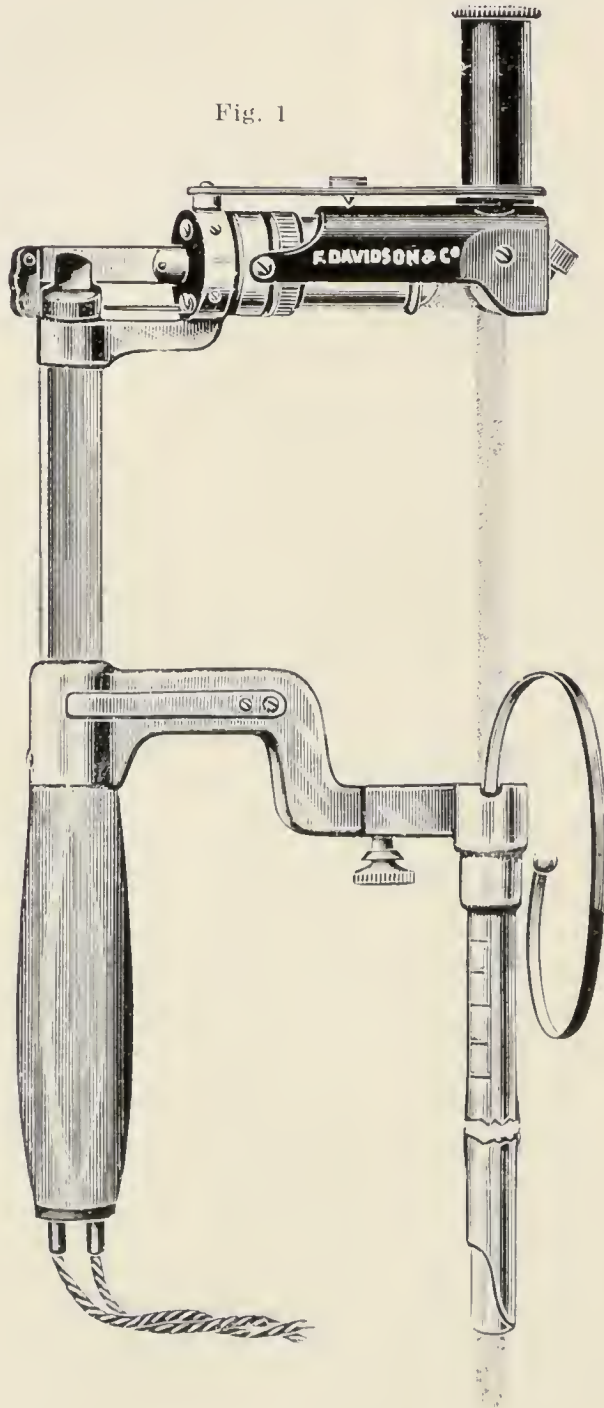
- A. Handle with:—
 B. Make and break contact by means of which light can be turned on
 C. Inner tube with optical system. [and off as desired.
 D. Outer tube having at its extremity two lamps E. E.
 F. Ball by which position of lens can be known when instrument is
 G. Connecting Cords. [in the closed mouth.

The form of this apparatus will be easily understood from the illustrations. The handle A (containing the connecting wires) screws into the outer tube D. The inner tube C contains the optical apparatus. The position for this part is in the outer tube D. The condensing lens at the end of inner tube reaches a point between the two lamps E E. The knob or ball F is placed in direct adjustment with the lens and as in a cystoscope, serves to show the direction of the lens. When the knob is on top as illustrated, the pharyngeal vault may be observed and by depressing the handle, the posterior nares is brought into view. When the knob is turned downwards, the larynx, epiglottis and vocal cords may be seen. Turned to the right or left, the Eustachian tubes may be viewed. A suitable catheter in position is quite easily observed.

TO INTRODUCE THE INSTRUMENT.

Use it as you would a tongue depressor, the patient all the time breathing naturally. It is necessary that the muscles be kept relaxed as much as possible. Insert the pharyngoscope almost as far as the pharyngeal wall. Do not let the pharyngoscope touch it. Depress the tongue and tell the patient to close his mouth and breathe through the nose. Keep the instrument firmly in position and the examination of the various parts may be proceeded with, as indicated above. It is seldom that one has to anæsthetize the throat. It may be necessary, where a gag has to be inserted, to use cocaine on the posterior pharyngeal wall.

DR. BRÜNING'S INSTRUMENTS FOR DIRECT ŒSOPHAGOSCOPY
AND LARYNGO-TRACHEO BRONCHOSCOPY,



APPLIANCES FOR USE WITH Dr. BRÜNING'S ELECTROSCOPE.

Fig. 2.

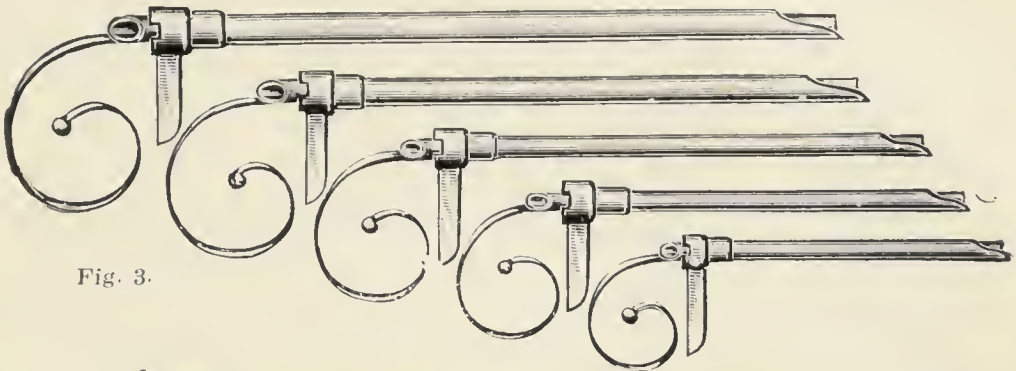


Fig. 3.

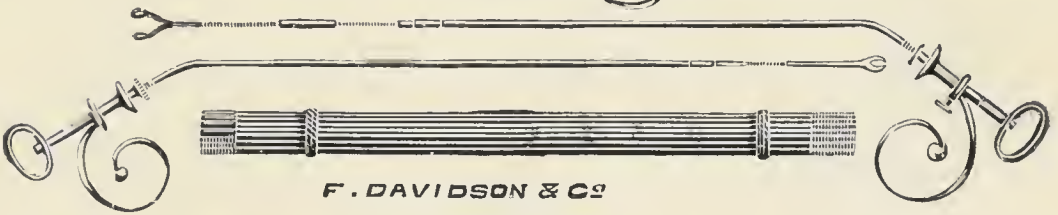


Fig. 4

No. 517

The equipment consists of: the lighting apparatus, fig. 59; the bronchoscope tubes and accessories, figs. 2 and 3; the operating instruments, figs. 4 and 5.

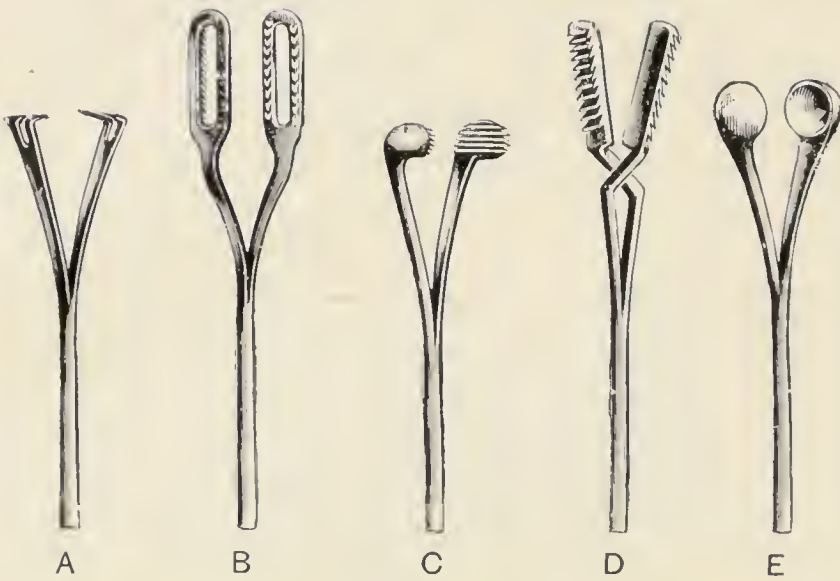
The advantages are facilitation of the introduction and rapidity of adjustment and the enlargement of the field of vision and field of work.

The lighting apparatus fig. 59 combines the advantages of the headlamp and electroscope; on the one hand it makes the lighting independent of the skill of the operator and on the other it allows the unimpeded handling of the instruments. The light far surpasses that of anything yet attempted and is sufficient for the use of telescopes of 10 fold magnifying power. It is powerful enough to allow of diaphanoscopy of the stomach!!!

The telescope fig 1, magnifies 10 diameters and can be focussed by means of a ratchet to a distance of from 20 to 50 centimeters and is used where closer examination is required. It can easily be removed when not necessary.

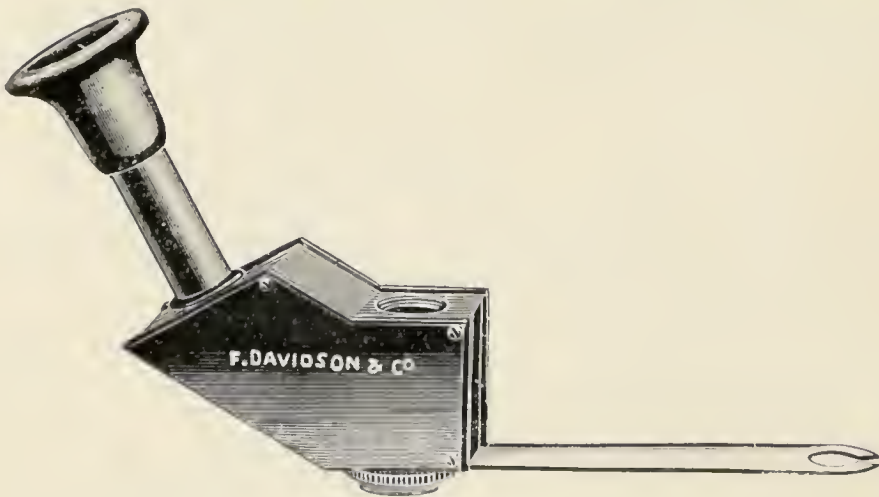
No. 517.

Fig. 5.



See description in the "Lancet," Nov. 7th, 1908.

DOUBLE PRISM FOR TWO OBSERVERS.



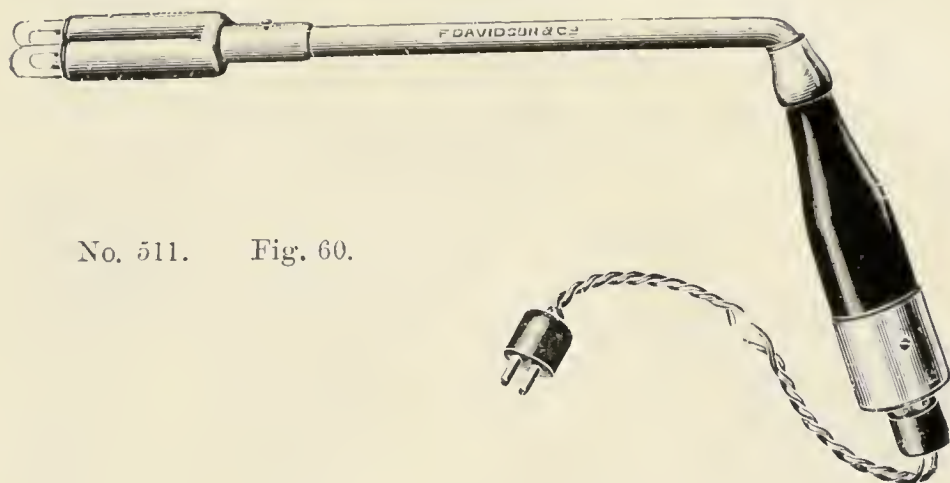
No 517

Fig. 6.

The double prism, fig. 6, which can be attached to the electroscope in the same manner as the telescope, serves the purpose of demonstrations during which the demonstrator can keep the object under discussion in focus and show it at the same time. It is also used in teaching bronchoscopic technique, as it enables the teacher to control the manipulations of the student.

APPARATUS FOR TRANS-ILLUMINATION.

Suggested by DR. LEWIS JONES.



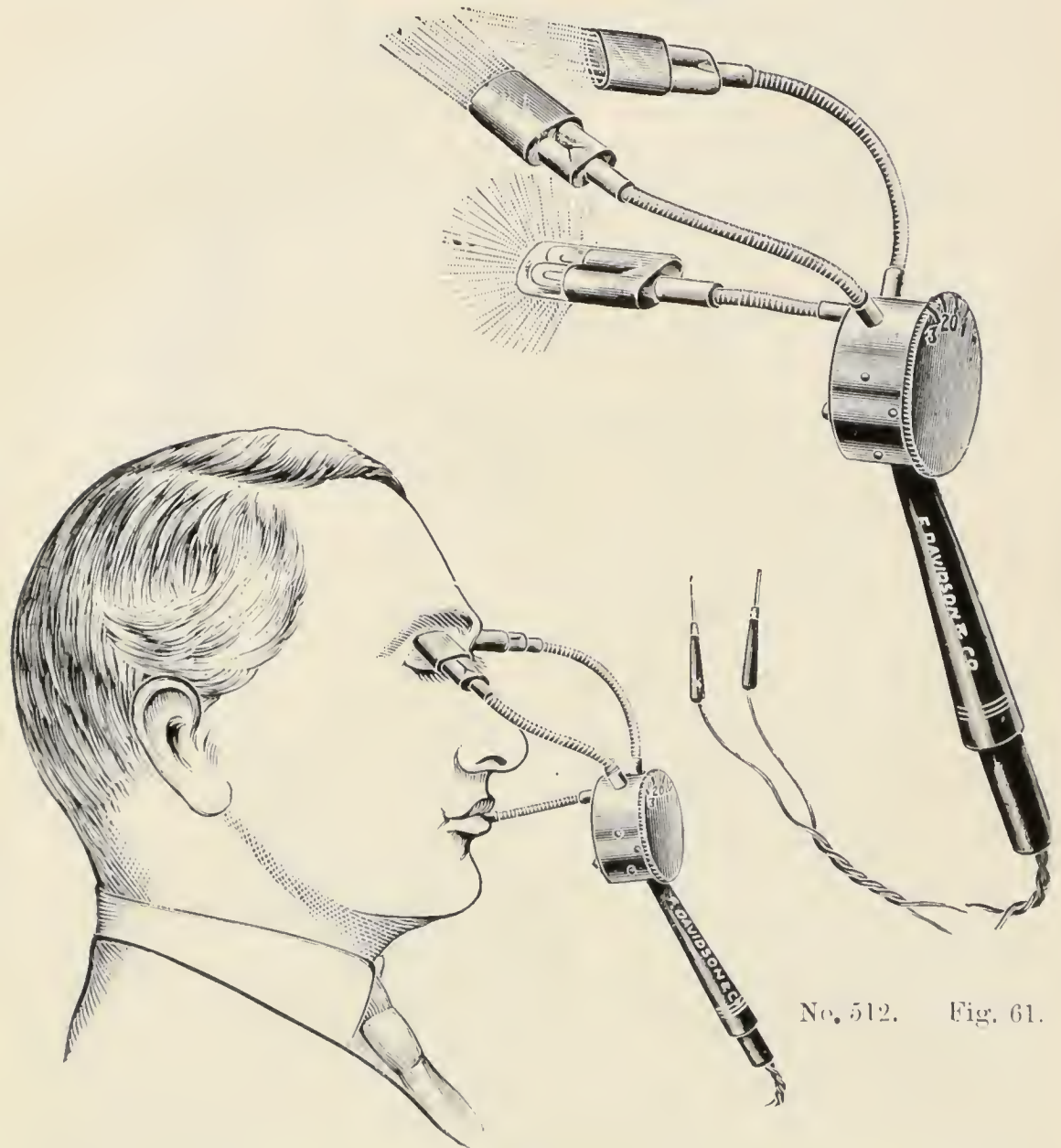
No. 511. Fig. 60.

The handle is vulcanite: at the lower end is a metal collar. This is turned slightly to right or left to alter the intensity of the light.

The single and double frontal sinus fittings contain respectively one and two $\frac{1}{4}$ in. lenses which are placed over the lamps for illuminating the frontal sinuses. The naked lamps are used for trans-illumination of the antrum. The light of metallic filament lamps, passing through these lenses is of great intensity and penetration.

For illumination of the sclera, the twin lamp fitting 5 A. is removed and a single lamp is inserted. The single sinus fitting 5 B. is placed over the lamp and pressed against the sclera.

Dr. Scanes Spicer's TRANS-ILLUMINATOR
for the simultaneous or separate illumination of both
frontal sinuses and antrum.



THE ILLUMINATION IS BRILLIANT AND EFFECTIVE.

There are 3 flexible metallic tubes, each having at its extremity a fitting containing two metallic 4 volt lamps. For the sinuses, vulcanite light concentrators are attached. For the antrum, there is a glass fitting over the lamps, for aseptic purposes. A rheostat is fitted to the handle, the dial of which is marked 1, 2, 3. An index hand on the dial is moved to the number of lights required at one time. When moved to No. 3, both sinuses and the antrum are illuminated simultaneously.

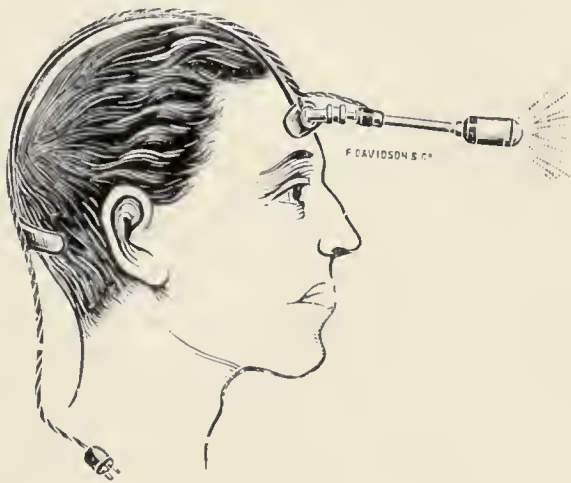


RHINOSCOPE "B"

No. 262. Fig. 62.

LONG STEM PHOTOPHORE.

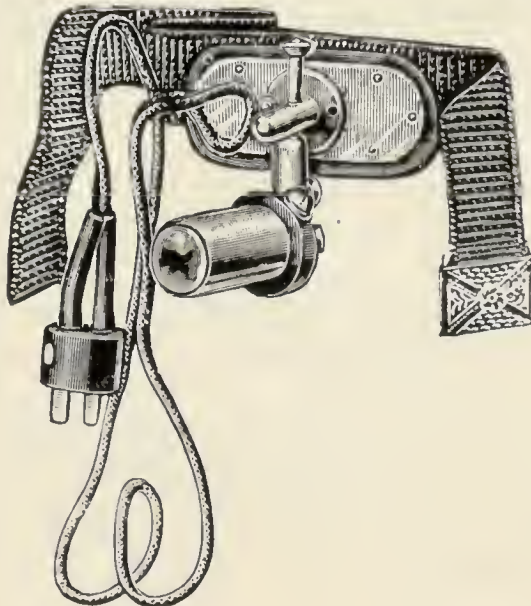
With Ball and Socket Joint.



No. 513.

Fig. 63.

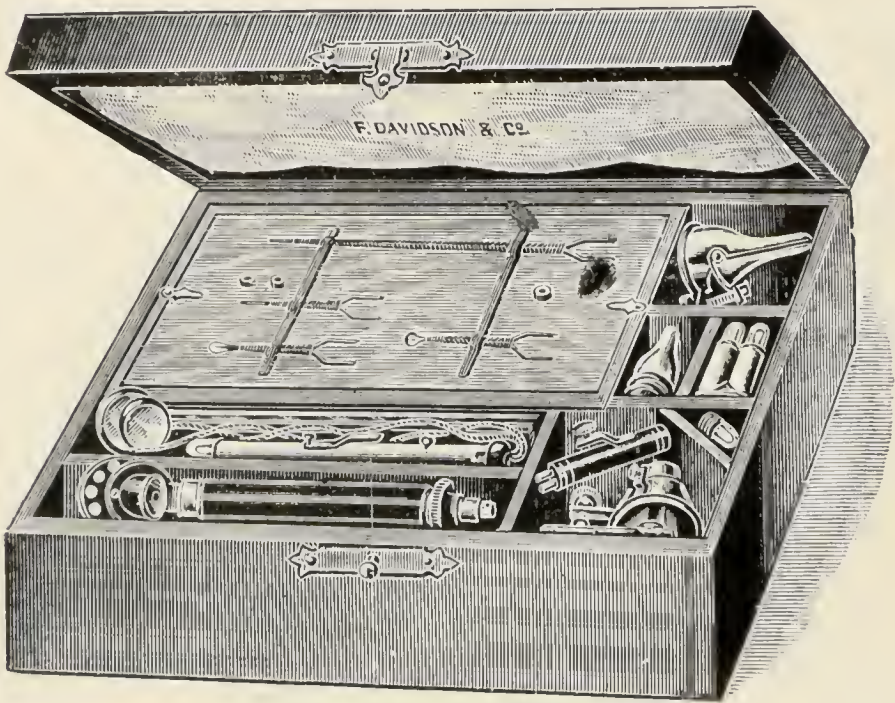
PHOTOPHORE WITH HEAD BAND.



No. 514.

Fig. 64.

OUTFIT FOR EXAMINATION
OF THE
EYE, EAR, NOSE AND THROAT.
ALSO FOR
TRANS-ILLUMINATION AND CAUTERY.

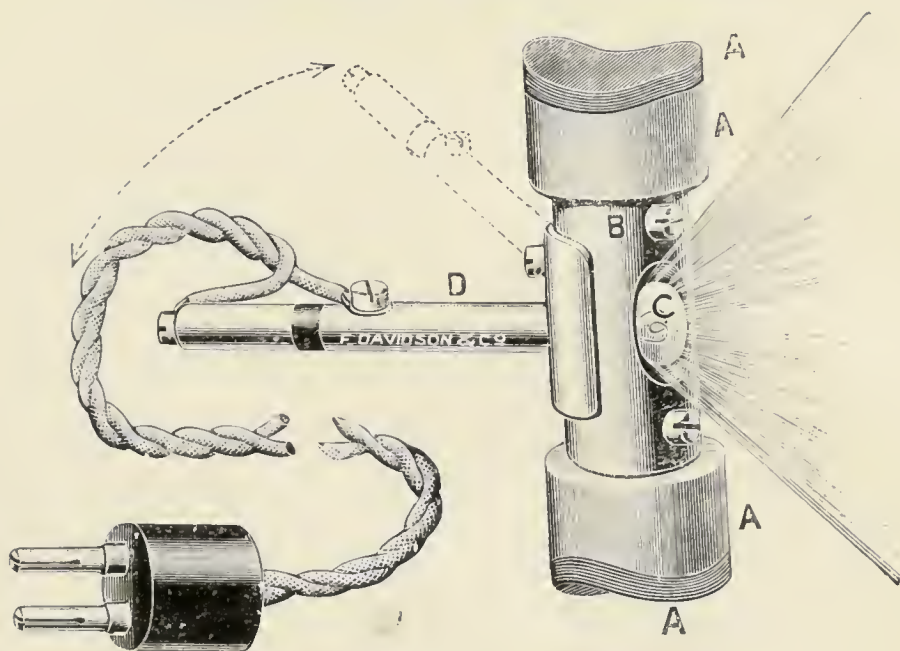


No. 54. Fig. 65.

A portable set of appliances for examination of the eye, ear, nose and throat, trans-illumination and cautery, which may be used either with the "Davon" batteries supplied, or on the house current through a suitable rheostat (see figs. 31 to 34).

This set comprises all the articles listed on pages 115 and 116, together with Davidson's patent ophthalmoscope, and handle and burners for cautery.

ELECTRIC MOUTH GAG.



No 515. Fig. 66.

The difficulty frequently experienced by both doctors and dentists in mouth operations, is entirely overcome by the use of this unique instrument. Its advantages are obvious. No matter how much pressure is brought to bear upon the cushions by the patient's teeth, the lever handle always enables one to direct the light to any part of the mouth. It occupies very little space and can be placed at each *side* of the mouth as well as in the centre. The shorter of the two pairs of cushions enables the gag to be placed *far back* in the mouth.

The lamp is easily detached and replaced.

WHITEHEAD'S ELECTRIC MOUTH GAG.

No 516.

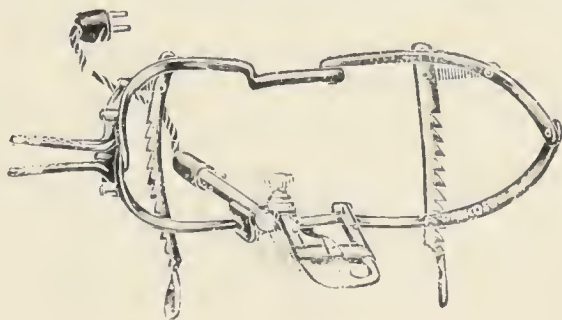
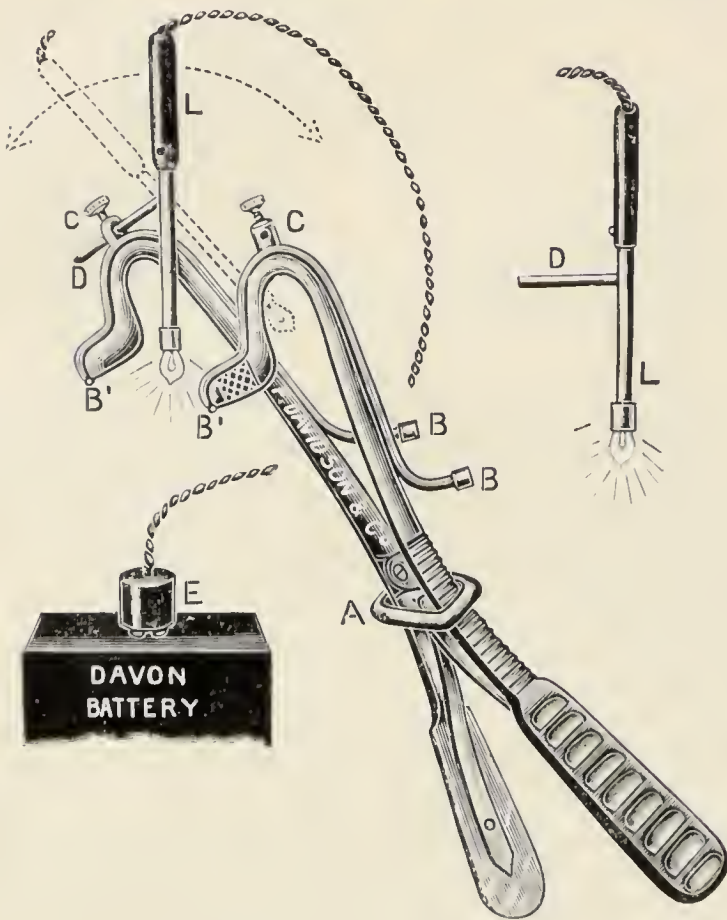


Fig. 67

ILLUMINATING MOUTH GAG.



No. 516 A. Fig. 68.

- A. Moveable ring for fixing arms of gag.
- B B. Tubes for conveying chloroform into the mouth.
- B' B''. Openings of chloroform tubes inside the mouth.
- C C. Sockets with clamping screws, into either of which the rod D can be placed, so that the light L can be turned either to the right or left.
- E. Connexion to Davidson's "Davon" Battery.

Complete with "Davon" Dry Battery.

Mr. Hewitt's Gag electrified as suggested by C. H. Leaf, Esq., F.R.C.S.

Extract from "The Lancet," 12/2/10.

"Two difficulties with which the surgeon may have to contend when operating inside the mouth, are the want of space and light. The first of these is obviated by Hewitt's ingenious device of carrying the chloroform tubes along the arms of the gag, so that a separate tube

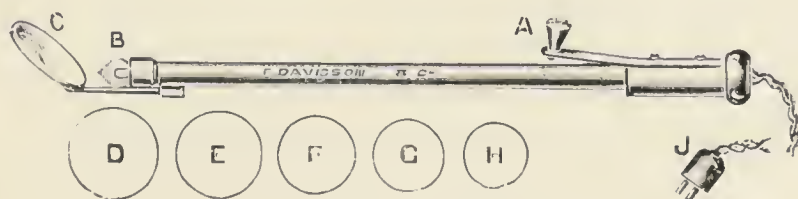
for the anæsthetic is not required, and the surgeon can therefore have all the space inside the mouth to himself. To overcome the second difficulty, I have had attached to Hewitt's gag (which not only by virtue of its chloroform tubes, but in other respects, I consider to be the best of all mouth gags) a little electric light. This is so arranged that it can be fitted to either arm of the gag and turned to the right or left side as required, and it enables the surgeon to get a good view of the whole of the inside of the mouth. The light is supplied by the 'Davon' battery, which is an extremely handy and portable form of battery, and which lasts about ten hours. Being removeable it enables the whole of the gag to be sterilized by boiling. The accompanying illustration shows the main features of the gag as thus modified, and I need only add that Messrs. Davidson & Co., of 29, Great Portland Street, W., having taken the greatest pains, have been most successful in carrying out all the suggestions I have made to them in regard to it."

Wimpole Street, W.

CECIL H. LEAF, F.R.C.S. Eng.

MOUTH MIRROR WITH FIVE RE-FILLS

(ASSORTED SIZES).

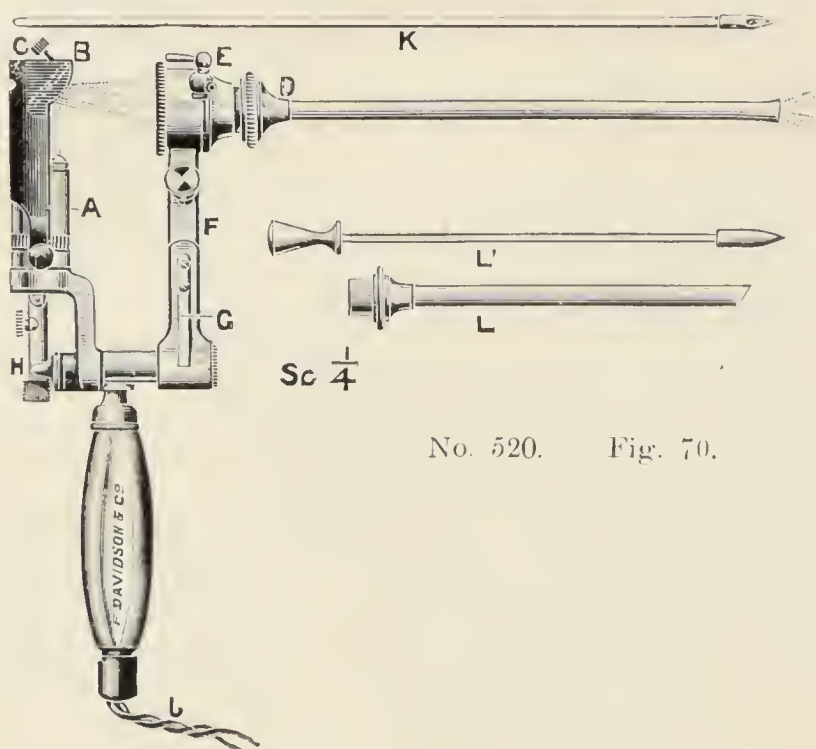


No. 3 A. Fig. 69.

- A. Make and break contact.
- B. Electric bulb.
- C. Mirror.

URETHROSCOPE.

Adapted by Mr. Davidson from Dr. Brüning's Bronchoscope.



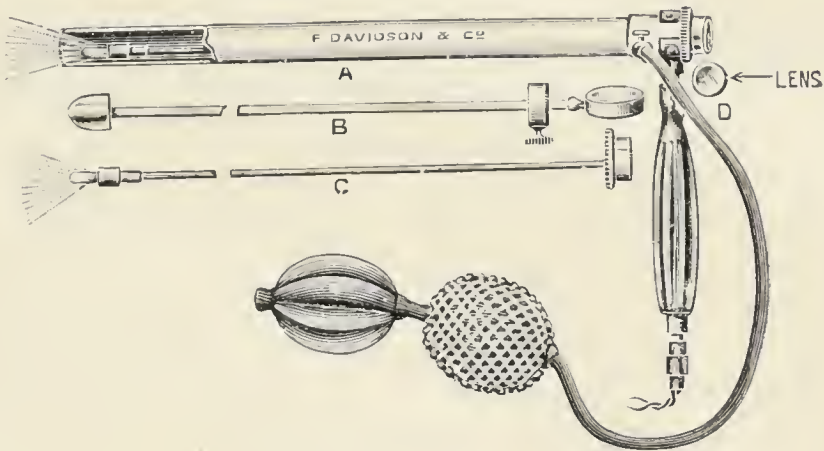
No. 520. Fig. 70.

The illuminating system is the same as Dr. Brüning's Bronchoscope, the lamp being of the same special construction which permits of great penetration and no obtrusion of the filaments. The lamp is situated at "A," the light passes through the condenser fixed over it and impinges on the mirror "B" and travels directly into the tube "D." The thumb screw "C" enables one to adjust the angle of the mirror for this purpose. Attached to the tube holder at "E," is a tap for inflation. Attached to the socket "F" is a spring "G" which allows the former to be adjusted to the right or left for convenience of the operator. "H" is the "make and break" contact; "I" the connecting cords; "K" the irrigation tube. "L" shows the form of the urethral tubes with guide "L I."

In the opinion of one of our most eminent surgeons: "*It is the best I have seen.*"

RECTOSCOPE or SIGMOIDOSCOPE (Strauss'),

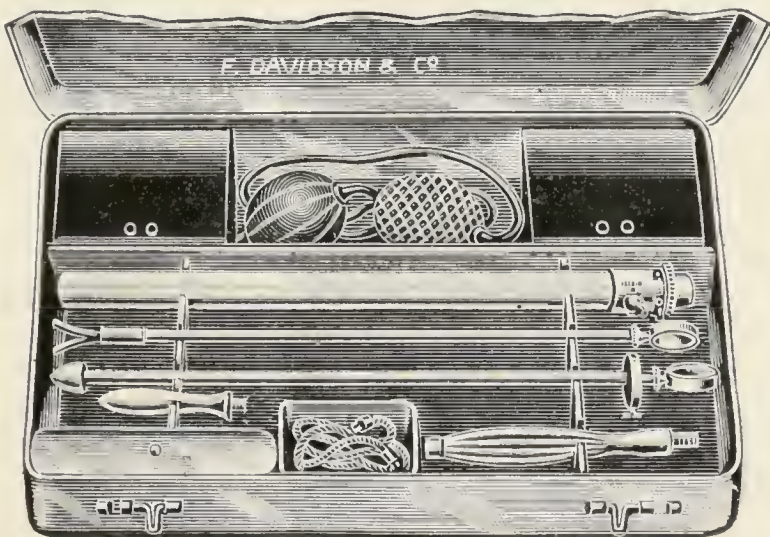
With magnifying lenses and metallic filament lamps, giving brilliant illumination.



No. 527. Fig. 71.

A. Tube. B. Guide. C. Rod with lamp. D. Lens.

COMPLETE IN ASEPTIC CASE.



No. 528. Fig. 72.

CYSTOSCOPE,

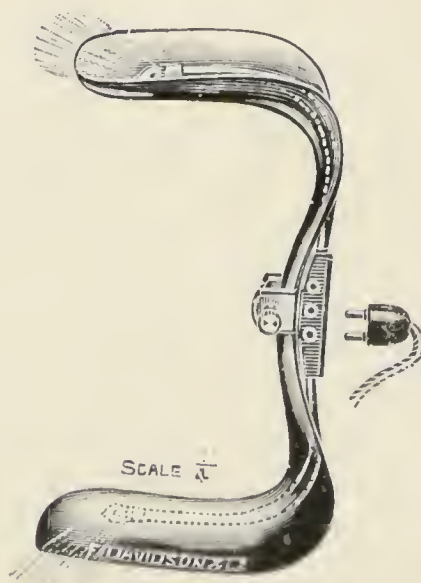
After Mr. HURRY FENWICK.



No. 521. Fig. 73.

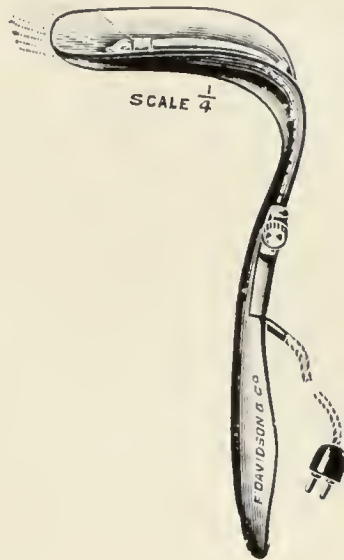
Giving brilliant illumination.

SIMS' DOUBLE SPECULUM, ELECTRIFIED.



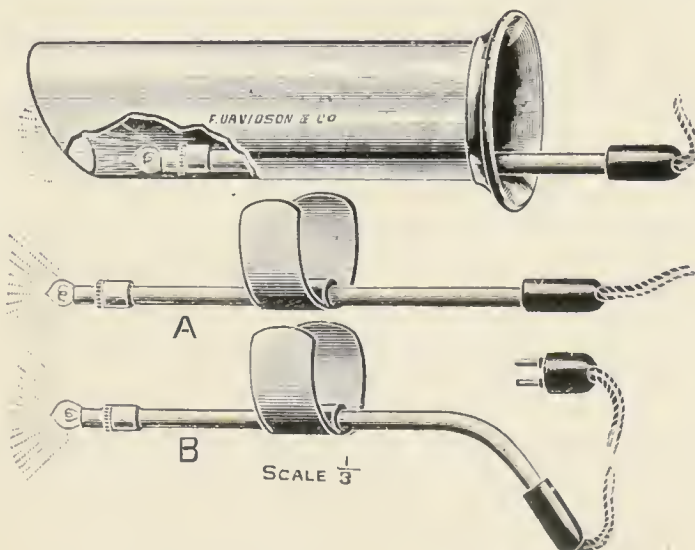
No. 522. Fig. 74.

SIMS' SINGLE ELECTRIC SPECULUM.



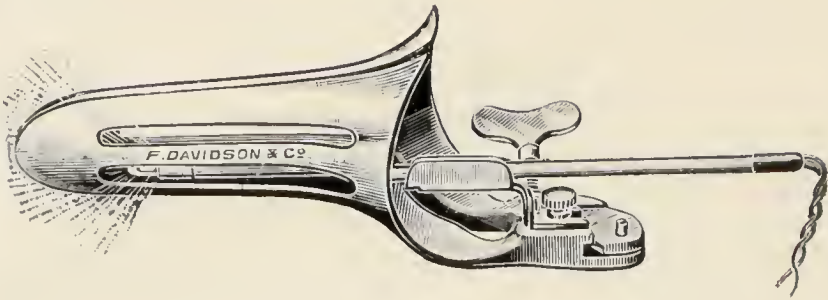
No. 523. Fig. 75.

FERGUSON'S SPECULUM, ELECTRIFIED.



No. 524. Fig. 76.

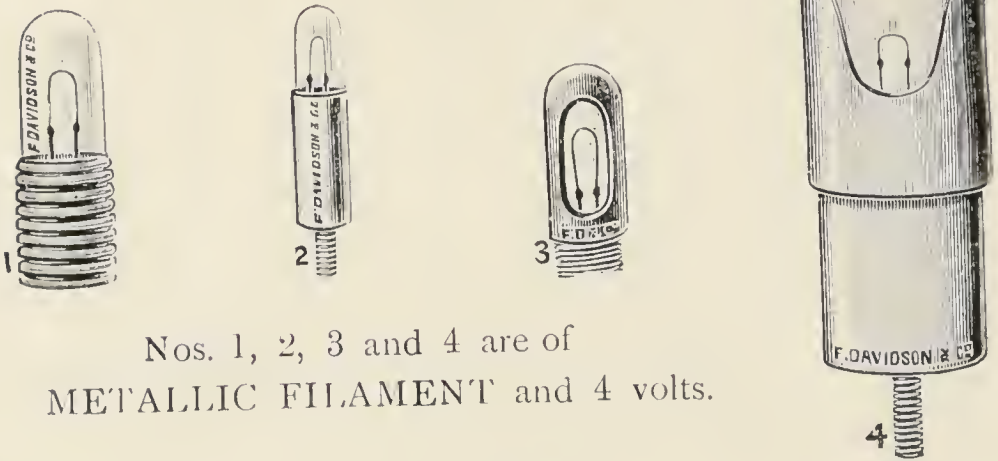
ILLUMINATED VAGINAL SPECULUM.



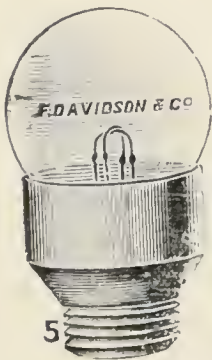
No. 525. Fig. 77 L.

SURGICAL LAMPS.

Fig. 71.



Nos. 1, 2, 3 and 4 are of
METALLIC FILAMENT and 4 volts.



No. 5.

Fischer's Lamp, 10 volts, Carbon
Filament, as used in Brüning's
Bronchoscope and Urethroscope.
A concentrated beam of light is
projected, the rays crossing as
shown in illustration.

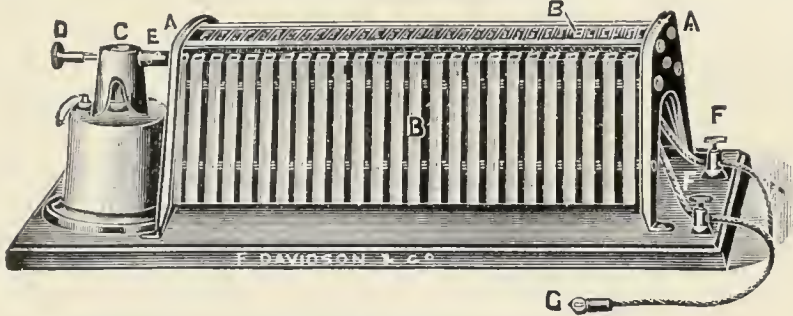


- No. 1. For Laryngoscopic and General Lighting Tube.
 „ 2. „ Rectoscopes and Sigmoidoscopes.
 „ 3. „ Cystoscopes.
 „ 4. „ Spatula.

DAVIDSON'S THERMO-GENERATOR. AN OLD IDEA BROUGHT UP TO DATE.

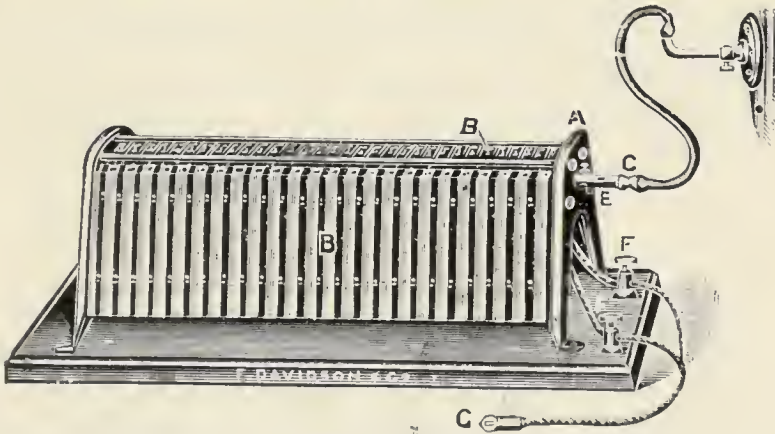
The fact that electricity may be generated by the liberation of the elements of certain metals, has been known for 25 years or more. The THERMO-GENERATOR (patent pending) illustrated below, provides, in a practical form, a means by which it can be utilized. The elements are liberated by heat supplied by gas or by means of a vaporized gas generated by a lamp burning methylated spirit.

PATENT APPLIED FOR.



No. 3. TYPE A for Spirit.

Fig. 78.



No. 3. TYPE B for Gas.

Fig. 79.

IT WILL GENERATE ELECTRICITY IN LESS THAN
ONE MINUTE.

Two metal plates A A are fixed to a base board. Two rows of hollow copper tubes B are placed vertically between them. These are connected at the top, each with its neighbour. C is a lamp burning methylated spirit. D is a handle connecting to a round tube E which runs right through the apparatus between the copper tubes. This round tube is perforated at intervals through its entire length. F are the terminals to which accumulators or appliances are connected. G shows a small lamp attached.

The THERMO-GENERATOR may be used for :—

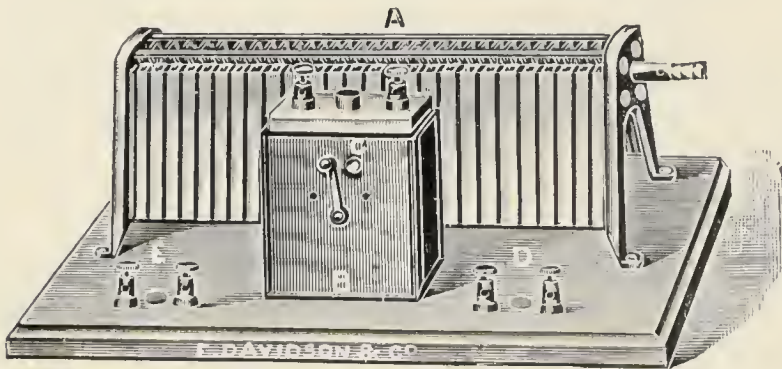
- (1) Illuminating small surgical lamps (4 volt).
- (2) Re-charging small accumulators (2 volt) or 4 volt if each cell is charged separately.
- (3) For running Faradic or sledge coils.
- (4) For light cautery.
- (5) For supplying light to a reading or ophthalmoscopic lamp.

TYPE A. The tank belonging to the lamp C is all but filled with methylated spirit, and a match applied to the wick on both sides. A gas is given off which travels through the perforated tube E. A light is applied to *each* of these perforations and *within a minute* electricity is generated which may be used for illuminating surgical lamps or re-charging small accumulators.

TYPE B is for use with gas, it being only necessary to attach one end of a rubber tube to C and the other to a gas jet as illustrated. Turn on the gas (not full) and light up at the perforations as in Type A.

Two sizes are made in each type. The larger has the greater output.

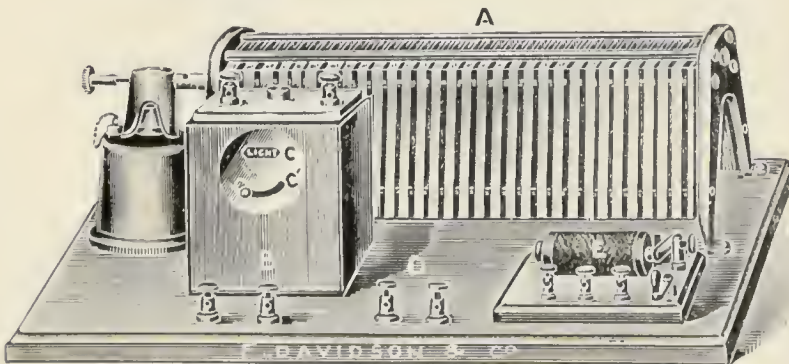
THERMO-GENERATOR for Light and Cautey AND FOR WORKING A FARADIC COIL.



TYPE B I. Fig. 80.

TYPE A 1 Spirit Generator for light and cautery.

„ B 1 Gas „ „ „ „



TYPE A 2. Fig. 80 A.

TYPE A 2 Spirit Generator complete with cautery appliances and Faradic Coil.

„ B 2 Gas „ „ „ „ „ „ „ „

For purposes of cautery a 20 ampère hour accumulator (2 volts) is connected to the Thermo-Generator. A commutator or a 3 way switch is provided. On the right are the terminals for illumination and on the left those for cautery. The accumulator can be kept fully charged by switching on to the Thermo-Generator for an hour or two once a week. It can thus be always kept ready for use, needing but a re-plenishment of the acid (one part sulphuric to five of distilled water) about once a year.

THE THERMO-GENERATOR
WILL PROVIDE LIGHT FOR READING BY MEANS OF
THE THERMO LAMP, with metallic filament bulb.

No. 65 .

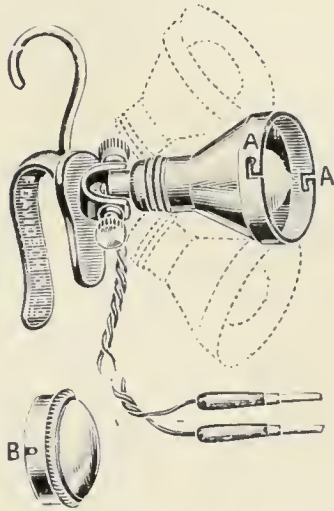


Fig. 81.

The Thermo lamp may be used with or without the condenser with either type of generator. With the condenser in position

A Portable Lamp for ophthalmic or laryngoscopic work is provided.

The Thermo-Generator will provide power for running small model lathes, fans, tools, &c.

PRECAUTIONS.—After the gas has been turned full on—or the spirit lamp lit for 3 or 4 minutes—lower the flame to about half. Only sufficient heat should be employed to illumine the lamp. Too much heat continually employed, would melt the metal connections while *no more* light or power would be generated than with less heat.

After in use for a while, an oxide deposit will form between the rows of terminals above the flame. **THIS SHOULD BE REMOVED WHILE HOT** (when the gas is burning). Run a stick lightly between the rows. *Under no consideration whatever must it be removed when cold* or the generator will be spoiled.

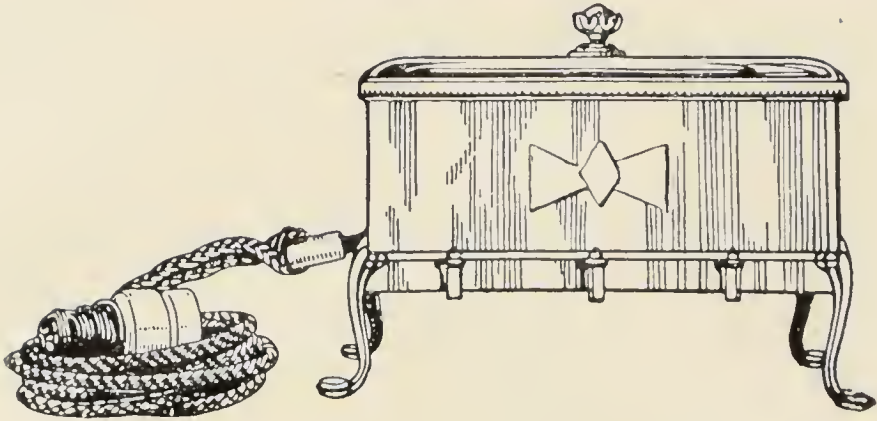
Turn out the gas or lamp immediately you have finished using the generator. **TAKE CARE IT IS NOT DROPPED.**

It is quite portable, as will be seen by the weights and sizes.

No. 2,	Type A,	weight 5 lbs.,	size $18\frac{3}{4}'' \times 6\frac{1}{2}'' \times 4\frac{1}{4}''$.
„ 3,	„ A,	„ $8\frac{1}{4}''$ „ „	$22\frac{1}{2}'' \times 7\frac{1}{2}'' \times 5\frac{1}{2}''$.
„ 2,	„ B,	„ $4\frac{1}{2}''$ „ „	$15'' \times 6\frac{1}{2}'' \times 4\frac{1}{4}''$.
„ 3,	„ B,	„ $7\frac{3}{4}''$ „ „	$18\frac{3}{4}'' \times 7\frac{1}{2}'' \times 5\frac{1}{2}''$.

Oak carrying Case for any of the above, extra.

ELECTRIC STERILIZER.



No. 700. Fig. 82.

No. 1.	...	...	$7\frac{1}{2}''$	\times	$3\frac{1}{2}''$	\times	$2''$.
No. 2	...	...	$8\frac{3}{4}''$	\times	$3\frac{1}{2}''$	\times	$2''$.
No. 3.	...	...	$13\frac{1}{4}''$	\times	$6\frac{1}{4}''$	\times	$2\frac{1}{2}''$.

For Direct Current 200 to 240 volts.

For Alternating Current 100 to 120 volts.

ELECTRIC FAN.



No. 750. Fig. 83.

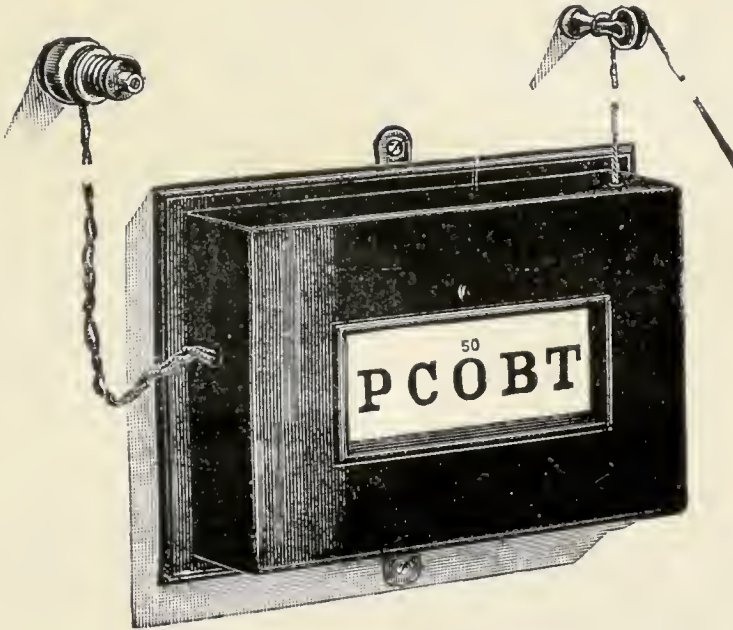
A useful little ventilating appliance which can be fitted to any existing lamp holder.

For 200 to 240 volts Direct Current main.

OPHTHALMIC TESTING CABINET.

SNELLEN'S TYPES.

MUSCLE TEST.



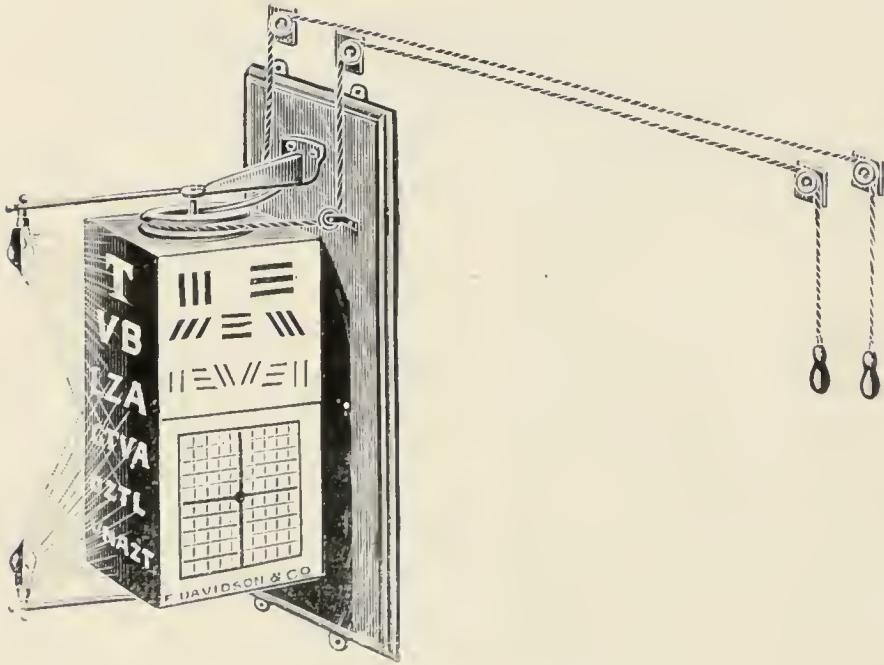
No. 533. Fig. 84.

The Testing Cabinet fills the place that has been open for one lighted from behind the chart and having an even illumination over the entire surface presented to the view of the patient. It has the advantage of enabling the operator to expose only one line of type at a time to the patient without moving from his seat, thus doing away with the possibility of misunderstanding as to what the patient sees, and in this way very rapid and accurate measurement of the visual acuity can be taken.

The Cabinet itself is made of wood with a dead black finish and is hinged at the top so that the inside can easily be got at to change lights, etc. Snellen's type is used and is printed on paper, as there is nothing else that will permit of having an even illumination for the letters. The one end of the strip of paper on which the type is printed, is fastened in a clip on a roller and the other end is fastened on a duplicate roller on the other side of the opening. These rollers are controlled by counter weights, permitting the chart to be stopped at any point without fastening in any way. The type can be exposed in front of the opening, as desired, by a cord operating the roller. This cord can be placed wherever desired and the cabinet operated from any part of the consulting room.

ILLUMINATED REVOLVING TYPES (*ELECTRIC*).

Operated from the patient's end of the room.



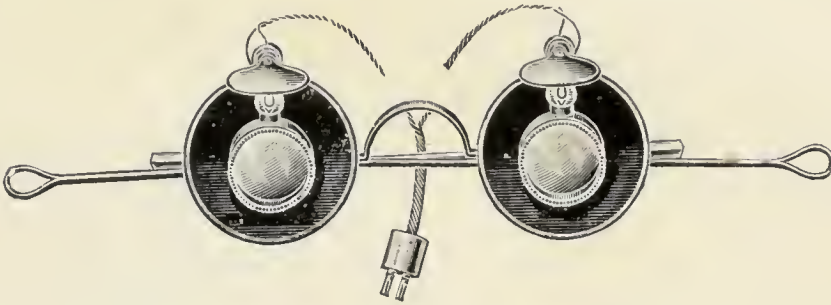
No. 532 Fig. 85.

There are two sets of Snellen's Types (black letters on white ground), one set of white letters on black ground, *line* test for illiterates and scale for use of the Maddox Rods at 10 feet.

DAVIDSON'S PLATYSCOPIC SPECTACLE

FOR THE PARTIALLY BLIND.

Suggested by Mr. DOYNE.



No. 530. Fig. 86.

Showing the Platyscopic Spectacle with electric illumination.

These are composed of either one or two

Perfectly Achromatic Lenses,

mounted in either glass or metal discs, and set in a spectacle frame: called respectively the single or the double platyscopic spectacle. The lenses are in fact miniature microscopes and although print must be held quite close to the eyes, *no fatigue is caused*. Their perfect achromatism accounts for this, there being an entire absence of color or distortion of any kind.

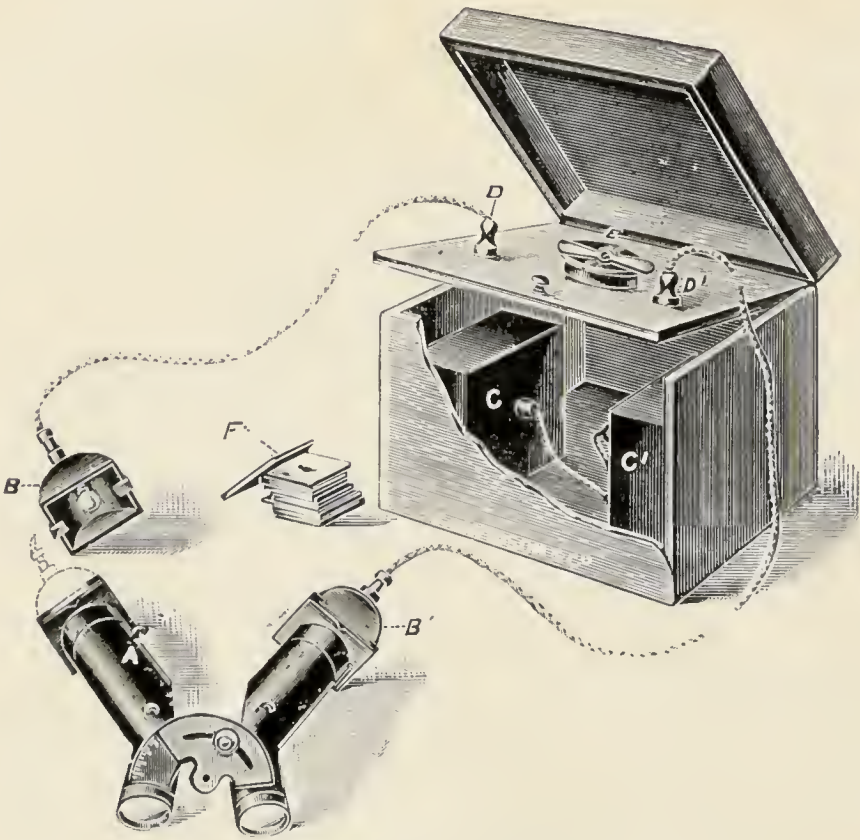
Every platyscopic lens has to pass our "Dot" test. This consists of an impression of a photographic plate on which there are upwards of 250 dots on a space $\frac{5}{8}$ " in diameter. They are quite invisible to the naked eye but each lens is required to show every dot distinctly and equally distinctly

at its greatest magnification.

THE AMBLYOSCOPE.

By CLAUD WORTH, Esq., F.R.C.S.

Author of "Squint, its Causes, Pathology and Treatment."



No. 529. Fig. 87.

The Amblyoscope is supplied with 34 Pictures in box (vertical and horizontal adjustment).

Also with illuminating attachment, 2 large "Davon" dry batteries and Rheostat.

Complete with detailed instructions taken by kind permission of Mr. CLAUD WORTH from the work mentioned.

MR. CLAUD WORTH'S PHOROMETER

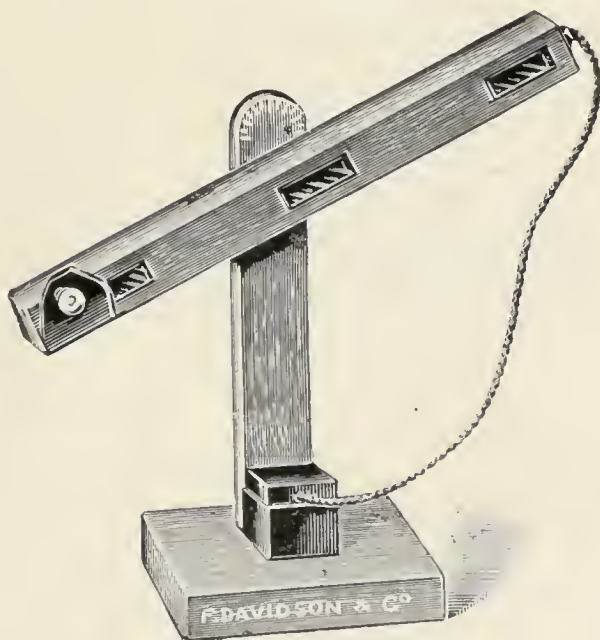
For the measurement of Heterophoria,

i.e., Esophoria, Exophoria, and Hyperphoria.

The only instrument which will ascertain the direction and measure

A COMPOUND DEFECT

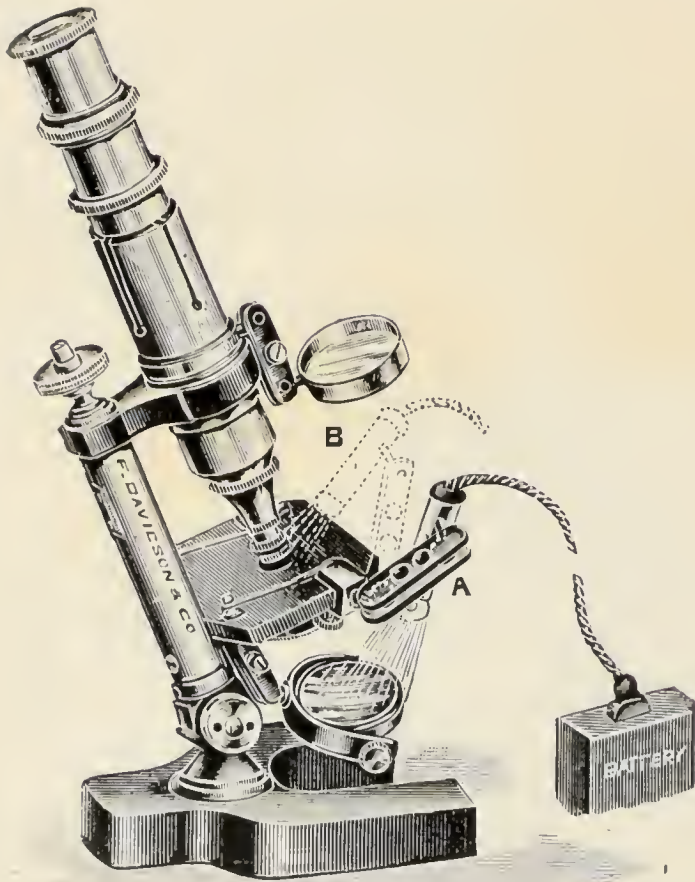
such as ESOPHORIA WITH RIGHT YPERPHORIA.



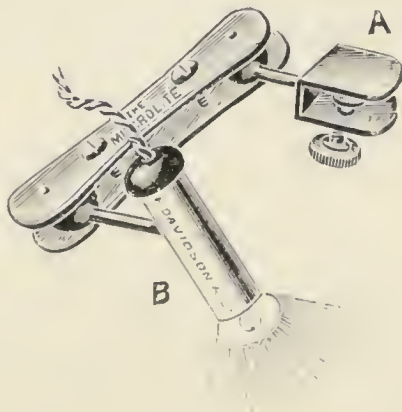
No. 531. Fig. 88.

A. Protractor. B. Rod shaped box with three slits: the centre showing red and the two ends green, being illuminated from behind. The box can be revolved in all meridians until the three lights appear in line. The angle for the altitude of the prism is shown on the protractor.

THE "MICROLITE."



No. 536. Fig. 89.



No. 536. Fig. 90.

The “**Davidson Microlite**” is an Electric attachment which has been designed with a view to place in the hands of the microscopist an illuminant which entirely eliminates the many disadvantages of the oil lamp usually employed.

The small source of light with the great intensity and perfect steadiness given by a metallic lamp together with an absence of diffused light, thus ensuring comparative gloom of the surroundings, are points that will commend the lamp to the experienced microscopist.

The attachment, when clipped to the stage, can be used for either reflected or transmitted light without removal. A universal range of movement, simplicity of adjustment, the cleanliness and saving of time and trouble are among the many advantages which render the attachment an indispensable adjunct to a microscopical outfit.

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